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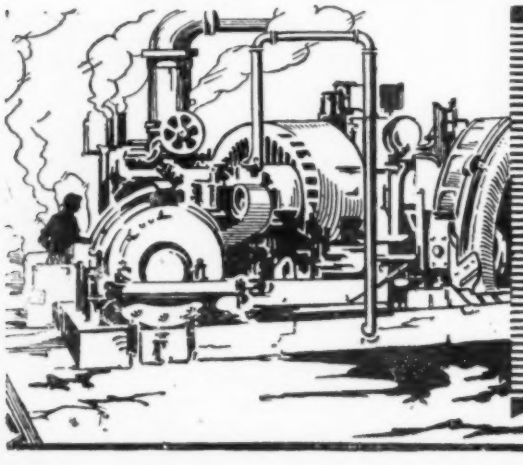

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L.C.C. Tramway Finance.

ON another page we treat in some detail a joint report of the Finance and Highways Committees of the London County Council upon expedients for relieving the financial situation of the Council's tramways.

We are glad to see that the idea of increasing fares was immediately abandoned. As with electricity supply, the aim must be ever towards lower charges, as the evidence available all goes to show the beneficial effect of such a policy—carried out judiciously, of course.

The next means, improved organisation, should always be pursued, and should not be looked upon as an expedient in times of stress. There is a possibility of grants being obtained towards the maintenance of the roads over which the cars run, from the Road Fund, but this is at best somewhat remote.

The rating of the tracks is considered. This is a perennial problem—and so far as London is concerned a paper one. The rates have to be raised somehow, and if, in paying a larger share than is perhaps just, the tramways are forced into debt, there has to be a special rate to cover the deficit. But we are not convinced that the tramways thereby become a charge upon the rates.

The next question examined was that of contributions towards the cost of street improvements, which is allied to the preceding matter. The tramways are again burdened with an unfair proportion of these charges while other undertakings escape them. But, as in the case of the rates, the money has to be found, and if the tramways have to pay more than they can afford there is a further rate on their behalf.

The Committees wisely decided against any further postponement of track-renewal payments by charging half the cost to the capital account; the account has to be settled with heavy interest at a later date.

The penultimate consideration was the expression of a hope that better conditions would prevail when the Traffic Advisory Committee commenced to function in earnest, in which all concerned will concur.

Finally, the Committees came to the decision, which was endorsed at a subsequent meeting of the Council, that the tramways had been repaying their debt too rapidly; that the life of their assets was longer than

the 25 years usually allowed them. Therefore, they proposed that the brake should be applied and that for three years the repayment instalments should be suspended, subject to the approval of the Treasury. This will result in relieving the revenue of about £900,000 during the three years, although ultimately more interest will have to be paid, partly offsetting the advantage gained.

It is to be hoped that during this period of suspense (in more ways than one) conditions will so improve as to enable the burden to be taken up again without causing even the paper deficit which provides such a good text for those who claim that tramways are obsolescent.

One daily paper in particular has devoted a great deal of space to unintelligent, and occasionally unintelligible, comments upon this question of the tramways' financial position. Tramways have no virtue in them; they could apparently be scrapped to-morrow with little inconvenience to anybody; and the County Rate would fall by several shillings. Such uninformed and unappreciative propaganda no doubt raises a temporary mild alarm, but it will soon give place to the next "scare." What is more serious is the attitude taken up by the *Morning Post*. Can it be that this responsible journal has allowed its hatred of public ownership to get the better of its judgment? Manchester has provided a practical refutation of this charge of obsolescence by announcing its intention of spending a further half million on its tramways.

The advanced ideas of Manchester are proverbial, and the business attributes of Glasgow are a household word. Surely if tramways are successful in those cities, the position of the London system is not so hopeless as we are asked to believe.

It is not the tramways which are at fault, but the circumstances in which they are forced to work—the heritage from the past and the burdens laid upon them by modern London traffic conditions. It is regrettable that uninformed criticism should be levelled at a system which has been proved beyond question to be the cheapest means of transport in urban areas when permitted to function on equal terms with its rivals. Have its critics ever visualised the appalling conditions that would obtain if the London tramcars were replaced by omnibuses of *equivalent seating capacity*? Even now, the Traffic Advisory Committee is about to restrict the number of 'buses plying in a large number of congested streets.

As Mr. J. M. Gatti, chairman of the L.C.C. Finance Committee, pointed out to the *Morning Post*, nearly half the cost of the tramways has been repaid out of revenue; the outstanding debt is £8,848,000, which would have to be repaid with interest out of the rates to the tune of £774,000 a year, together with £340,000 a year for road repairs and rates at present borne by the tramways, a total of £1,114,000 a year as the cost of scrapping the tramways.

The Women's Electrical Association.

It is now generally accepted that the load of the future is the domestic supply of electricity. In this country only the fringe of the matter has been touched, and even the United States electrical contractors are being told that they are backward and are not securing half of the business which is available. The question is pre-eminently one which affects women. So long as the average man is able to touch a switch when he needs light, he considers that he has enough electricity in the home. To the woman, to whom falls the task of keeping the home clean, and cooking what seems an endless succession of meals, lighting is not enough. She is beginning to wonder why, in this present era of time- and labour-saving inventions, she still has to utilise methods which were in vogue when her mother was a child.

It is one of the aims of the recently-formed Women's Electrical Association to foster this feeling of dissatisfaction to a point at which the only remedy—electricity—has to be applied. The Association means to secure the domestic rights which to a large majority of women are far more important than the vote. The success of the Association should be immediate, for the Provisional Council includes a number of people whose life work is the advocacy of electricity. The presence of Mr. J. W. Beauchamp on the Council is an assurance of the close co-operation of the new Association and the British Electrical Development Association, which have so much in common as to lead one to think that a women's branch of the older organisation would perhaps have fulfilled the same objects as well. The Women's Electrical Association, however, claims to be free from trade interest, and that may be the reason for the separate organisation; nevertheless, the E.D.A. is singularly unhampered in this direction, although a part of its funds comes from manufacturers. We welcome the new Association as a power for good in the advance towards the all-electric idea.

The Kelvin Lecture.

Those who were present at the crowded meeting of the Institution of Electrical Engineers on Thursday last will agree that the sixteenth Kelvin Lecture, delivered by Dr. J. H. Jeans, F.R.S., was in every way equal to the very high standard that this series, with few exceptions, has maintained. The fame of the author as a mathematician and physicist has encircled the globe; there is therefore no need to say that the very abstruse subject—briefly described as "Electrical Forces and Quanta"—was to him but child's play—the real excellence of his performance lay in the skill with which he made it intelligible to an audience, the majority of whose members were probably unfamiliar with the ideas of which he spoke. It was, as Sir Oliver Lodge declared, a masterly exposition; it was not a lecture but rather an address, in that conversational manner which enlists the sympathy and attention of the hearers, couched in familiar terms and illuminated, where needful, with simple analogies.

Sir Oliver, in moving a cordial vote of thanks, did not fail to put in a word on behalf of "an ether" or to question the validity of "action at a distance," which is repugnant to the mind of a physicist or an engineer, though the pure mathematician feels no such intuitive aversion. As he pointed out, the theories which Dr. Jeans had so lucidly outlined in most respects adequately *expressed* the facts, but they made no attempt to *explain* them. Whether a full understanding of their meaning and purpose will ever be attained by the human intellect is a problem for the future to solve; in the meantime we are grateful to Dr. Jeans and the other brilliant workers in this field who patiently add brick to brick and who during the past quarter of a century have reared so splendid a structure on the foundations laid by Faraday, Clerk Maxwell, and Kelvin.

I.E.E. Papers.

We wonder whether the Papers Committee of the Institution of Electrical Engineers devotes its attention to devising ways and means for obtaining good papers, or whether it is content simply to consider the merits of such papers as may come its way. If the latter, it seems that its office is tending to become a sinecure. Judging by results, the supply of papers worthy of presentation at ordinary meetings has been very scanty of late; as we pointed out in December, 1923, during the last session a few papers were being read again and again—even to 10 times in one case—at the Local Centres, and in the course of the current session a thesis presented as an A.M.I.E.E. qualification is being read at six Centres, whilst three papers are being presented each at four or five Centres, and there are several cases in the programme of "subject to be announced later." Now, the Institution is the largest engineering body in this country—its membership is not far from 12,000, and is rapidly growing; and recently the President expressed the opinion, with which we do not quarrel, that it was also the most important. Why is it that with so large and talented a membership the Institution is not able to produce a programme packed full with good material at every Centre and Sub-Centre?

We suggest that this is a matter of the first importance, to which the Council should give its most careful attention without delay.

If we turn to the American Institute of Electrical Engineers, we find the statement in its *Journal* for January, 1925, that "the crowded condition of the Institute's publications during 1924, which has been commented upon at various times during the year, reached a crisis at the close of the year." In order to start the new year with a clean slate, no fewer than 25 papers, including some of the most important of the year, were drastically cut down and published in the form of brief abstracts in the December issue of the *Journal*. The hope is expressed that the Meetings and Papers Committee will restrict this year's programmes to an amount that can be included in the *Journal*, and that authors will not exceed a limit of eight pages, on pain of abridgement.

The contrast is violent and painful. There must be a reason for it, and we suggest that the fundamental factor is the concentration of control over papers in the hands of a committee at headquarters. During recent years the committees of the local Centres have steadily grown in importance and capacity, and they are perfectly capable of exercising their own discretion with regard to the suitability of papers for discussion. If the Council does not take the initiative and recognise this fact, we anticipate that the Centres will attend to the matter themselves. "Youth will be served." That is one way to increase the supply of good papers; but it is not the only way, and the Papers Committee or the Council itself should take active steps to arrest a tendency which bodes ill to the Institution. A passive policy of waiting for papers to come in will do no good. The path should be made as smooth as possible, and all regulations and formalities which tend to restrict the free inflow of papers should be removed.

The Prevention of Fraudulent Bankruptcy.

SOME time ago, in response to the general feeling among business men that there was a necessity for the tightening-up of the existing bankruptcy code, the Board of Trade appointed a commitee, under the chairmanship of Mr. E. W. Hansell, to consider the matter. This Committee has now reported, and its recommendations are given in detail in our "Business Notes."

The Committee expresses the opinion that for ordinary purposes the Act of 1914 is adequate; accordingly its efforts were directed towards the provision of means for preventing fraudulent bankruptcy. This form of larceny, which of recent years has become very common, is no doubt easy to commit and hard to punish under the existing laws, but we think that if penalties for the offence are a deterrent, the adoption of the Committee's proposals will lead to a diminution in the number of fraudulent bankruptcies.

In our own industry, and particularly in the lamp branch, the names of many bankrupts whose prior conduct has been extremely questionable have had a distinctly foreign sound. We are not sure that British defaulters are any more desirable than alien ones, but it is interesting to note that the Committee suggests that the Bankruptcy Court should have power to recommend the deportation of aliens guilty of offences under the Bankruptcy Act.

German Turbines for Norway.

THE feeling raised in Norway through the Government having placed orders with a German firm for two large turbines for the Nore hydro-electric works, shows no sign of abatement. One order was allocated to this source in the middle of November, this being followed by many protests in the newspapers and giving rise to a state of bitterness among Norwegian engineers. Suddenly—and that too when the Norwegian Engineers' Association was celebrating its golden jubilee and many flattering remarks were made about national engineering skill—the second blow was delivered by the Government, which ordered an additional turbine from the foreign firm. The *Teknisk Ukeblad*, discussing the matter, repeats a rumour that the Government gave the second order without waiting for a report by the State Water Power Administration, and declares that the blow delivered against the Norwegian turbine industry is ill-advised. "We must consequently be prepared," the journal says, "for German smartness to be rewarded in the future by the Norwegian State with new orders when the Nore gradually gets its mechanical equipment. As a German firm can now advertise that it gets orders from the Norwegian State—from a country whose turbine industry in the course of many years' fight has gained the world's recognition—truly the outlook for our industry is not bright." The action of the Government in the matter of the turbines has also been keenly criticised by the labour newspapers. The *Norges Handelstidende* says that what the State saves by ordering the two turbines abroad will play quite a moderate part in proportion to the whole expenditure on the Nore works. The remunerativeness of the works would not have been materially affected if the turbines had been ordered in Norway at the higher prices quoted. It is claimed that Norway has no need to go abroad to secure high-class turbine work, and that the country possesses more high-pressure installations than any other nation. The future will witness enormous developments in this direction, and under these circumstances it is suggested that technical progress should be promoted to the highest degree; also that the State, instead of embracing an opportunity of supporting this development, has preferred to assist foreign competition.

Shadows in Illumination.

A SUGGESTIVE paper was read before the Illuminating Engineering Society on January 27th by Mr. J. W. T. Walsh, who discussed the effect of shadows from obstructions, and methods of calculating their effect in diminishing the available illumination. One of the chief points brought out was that shadows caused by very large luminous diffusing surfaces, such as those which form the sources of light in indirect systems of lighting, may be so soft as to be inappreciable to the eye, but nevertheless quite evident to the photometer. The same fact holds good for illumination received by the reflection of light from walls and ceilings, even in direct systems of lighting. A person bending over a desk may cast a shadow which greatly reduces the illumination on his book and paper, though he may be unaware that such a shadow exists. Thus, no system of lighting is really "shadowless." Such effects are often unwittingly ignored, even by the lighting expert, in planning installations. Mr. Walsh mentioned the case of a system of lighting which appeared entirely adequate when installed in an empty room, but seemed insufficient when bulky, dark-coloured machinery was introduced, owing to the obstruction of light from the white walls. In making photometric measurements, such shadows are a source of considerable difficulty. The observer can guard against making measurements in shadows cast by direct lighting units, which are evident, but his readings may, without his being aware of it, be affected by very soft and inappreciable shadows cast by indirect lighting systems.

Some reference was also made at the meeting to new activities of the Society, which is evidently losing no time in giving effect to the resolution passed at Wembley last year. The *Journal* is now being issued in an extended and revised form, and the announcement was made that a course of lectures on illumination, each by an expert on the particular phase to be dealt with, was being arranged at the Polytechnic, Regent Street. Another prospective novelty is the holding of informal gatherings, intermediate between the usual meetings, and a feature will be visits to lighting installations of special interest, which will be afterwards discussed. The Society is showing enterprise in devising these expedients for the instruction of its members and others interested in the movement for better lighting, and we hope that it will be rewarded by the whole-hearted support of the electrical industry, which should benefit from its good work.

E

The Development of Street Lighting in Croydon.

IN the very early days of electricity supply most station engineers turned to street lighting for the load to keep their plant running during the night, but it was rather

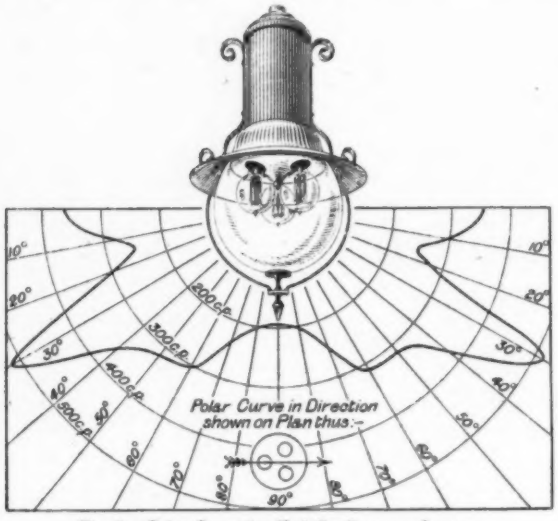

Fig. 1.—Polar Curve for High-Candle-power Lantern.

a difficult proposition at that time. Arc lamps of various makes, all possessing very grave disadvan-

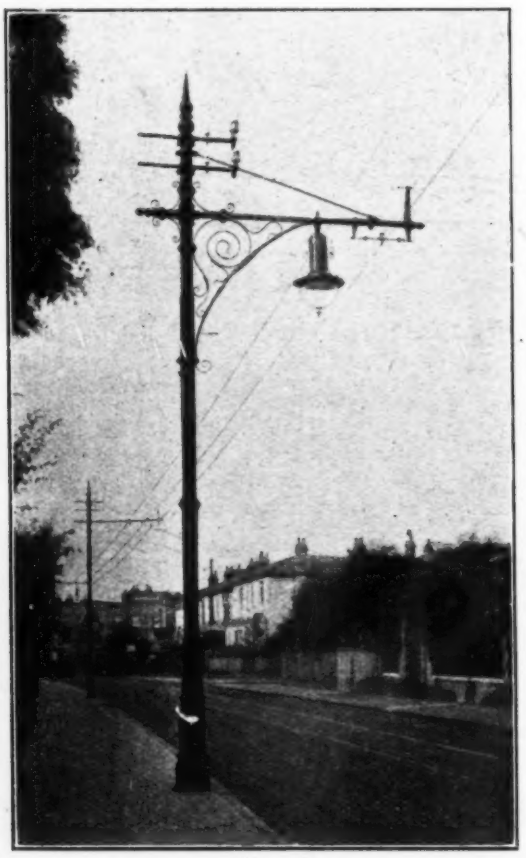

Fig. 2.—High-Candle-power Lantern.

tages from the maintenance point of view, though they gave a more brilliant light than their gas rivals, were available for the main streets, while for side streets, where first cost and maintenance charges made arcs too expensive, the choice of illuminants was restricted to carbon-filament lamps. These compared favourably with flat-flame gas lamps, but were at a disadvantage when incandescent gas mantles were introduced.

To meet the competition of gas mantles, at Croydon, two carbon filament lamps were used in each post, these lamps were fitted with special silvered backs, which concentrated the light in the direction of the street. These lamps were manufactured by the Improved Electric Glow Lamp Co., a firm long since forgotten except by those early engineers who were working in this direction.

In a paper read before the I.E.E. in 1905, Mr. Haydn T. Harrison gave figures which showed that in the side streets of Croydon Mr. A. C. Cramb had not only

Fig. 3.—Pear-Shaped Lantern with Metal-Filament Lamp.

succeeded in replacing gas mantles, but was giving 50 per cent. more direct illumination on the streets with these reflector carbon lamps.

When flame arcs had replaced ordinary arc lamps in the main streets, and tungsten-filament lamps had put the merits of electric lamps for side-street lighting beyond doubt, experiments were made in Croydon with a group of tungsten lamps in one lantern, placed at a good height above the ground, for use in those streets which were not of sufficient importance to require the higher degree of illumination obtainable by flame arc

lamps. The lantern which was ultimately evolved, and which is shown in fig. 2, was probably the most efficient lantern ever produced for use with tungsten filament vacuum lamps to give a circular distribution, and from the polar curve shown in fig. 1, it will be noted that the effective candle power on the road exceeded 500 when using three 100-watt Osram lamps, which at that time required 1.25 watts per candle power.

The first lantern adopted for side street lighting with metal-filament lamps is shown in fig. 3, but it was realised that too much of the luminous energy was wasted outside the street area. Mr. Cramb was satisfied from investigations of the efficiency of this lantern that, owing to the glass globes used being pear-shaped, there was an appreciable loss of lighting in the globe, and the lighting was distributed, more or less, in all directions, whereas the problem to be solved was to obtain the maximum illumination along the roads at a minimum cost. It was decided, therefore, to revert to a square lantern with a porcelain reflector, specially designed to reflect a greater portion of the light rays up and down the street.

Fig. 4.—Square Type Lantern with Porcelain Reflector for Metal-Filament Lamp.

Fig. 5.—Lantern with Triplicate Reflector for gas-filled Lamp.

After a considerable number of experiments, the lantern and reflector shown in fig. 4 was devised, this greatly improved the results in the illumination curve along the streets, due partly to the fact that the greater portion of the rays were deflected on the road surface where they were required, and partly to the square lanterns being fitted with thin glass sheets of uniform thickness and so placed that the rays of light passed through them at right angles, giving a higher efficiency. This lantern was adopted with a 60-watt tungsten lamp as a standard of illumination for the side streets, and the older types of lanterns were gradually replaced.

The period of war put a stop to all developments in street lighting, but during this period the gasfilled lamp was improved, and attempts were made to use this type of lamp with the above lantern, but the result was not satisfactory, as the reflector was not designed to deal with a filament concentrated at the bottom of the lamp, and the small area of the filament gave too concentrated a light.

In the meantime, however, Mr. Haydn Harrison had been experimenting in his laboratory on a type of reflector embodying the principles adopted by Mr. Cramb, but with regular plane reflecting surfaces at various angles in place of combined regular and diffusing curved surfaces, his object being to more closely concentrate the upper hemispherical luminous energy into the region of the road without producing the effect of a condensing reflector with its resultant glare. This he found was possible by reproducing several reflected images of the light source, each of which radiated light without giving the appearance of concentration, and by utilising a suitable size of plane mirrors and adjusting them to the correct angle, three or more reflected images were produced, each of which added 80 per cent. of the original power of the light source, thus with what is now known as the "triplicate" reflector, giving three images and the original source, the power is increased to 3.4 times the original.

A number of these reflectors were fitted to the square lanterns in Croydon, and tests were made on them. It was suggested to Mr. Harrison that the mirrors would be subjected to continual varying conditions of weather; in all probability there would be rapid deterioration in the efficiency of such mirrors, and some suitable means of fixing these and sealing with a substance which would

Fig. 6.—Three-light Triplicate Reflector Lantern.

Fig. 7.—Lantern with Mirror Reflectors grouped in a Circle for Cross Roads.

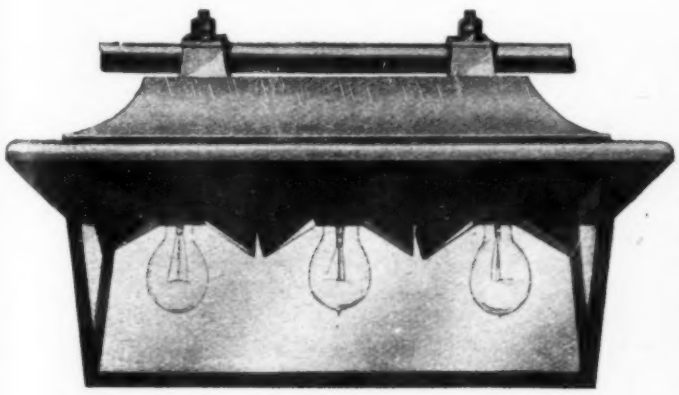

Fig. 8.—Three-Light Triplicate Reflector Lantern (for main roads).

Fig. 9.—Brighton Road at Night.

prevent damp or other weather conditions affecting the mirror were essential. Mr. Harrison then devised and patented suitable mountings and fixings to conform with these conditions, and this mirror reflector fitting, containing a 75-watt lamp and fitted in the standard square lantern, has been adopted for side-street lighting. A photograph of this lantern is shown in fig. 5.

Attention was next directed to improving the illumination of the main roads, and Mr. Cramb suggested to Mr. Harrison that the form of lantern with plane mirror reflectors which he had invented and which had been adopted for the side-street lighting, should be tried in a special lantern to test out an idea he had had for some years, namely, that as the bulk of the light is required up and down the road, the most efficient way

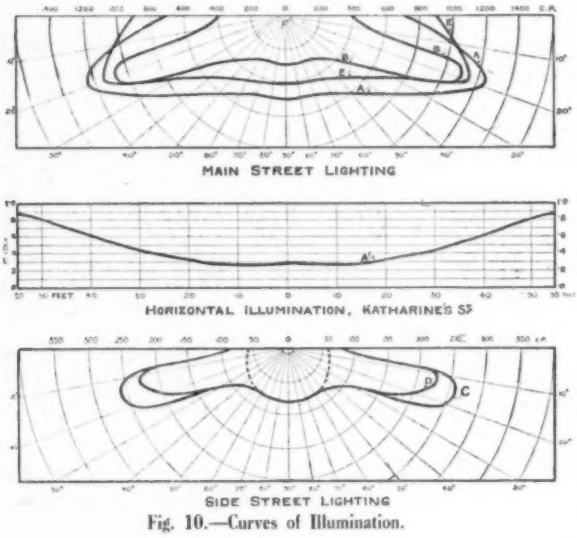

Fig. 10.—Curves of Illumination.

to get this result would be to get a band of light suspended at right angles to the street so as to give the maximum efficiency and evenness of illumination along the road. A lantern on these lines was eventually developed by the Street Lighting Apparatus Co., using three 100-watt lamps with suitable reflectors in a special lantern of triangular section, as shown in figs. 6 and 8. Three sample lanterns of this type were made up and tested on the main road, and Mr. Cramb was satisfied that this lantern accomplished the object of giving the maximum illumination with the minimum expenditure of electrical energy, and of reducing the ratio of maximum to minimum illumination along the road surface to a lower figure than had hitherto been obtained, so that the road appears to the eye to be evenly illuminated.

Fig. 9 shows a photograph of the Brighton Road taken just after midnight and dependent entirely on the illumination of these lanterns for the result. It shows that with these lanterns on a clear straight length of road it is possible to see almost any small object crossing the road at a considerable distance, the distance from the camera to the point further visible is just half a mile.

At cross roads this main-road lantern is not entirely satisfactory, and the lantern shown in fig. 7 with the mirror reflectors grouped in a circle has been devised to give more effective lighting in such places. In the case of main cross roads, these lanterns contain four 100-watt lamps, but at the less important cross roads a similar arrangement on a smaller scale is used.

The Electricity Committee being satisfied with the results from these lanterns, it was decided to fit the lanterns through the five miles of main road from Norbury to Purley, and great satisfaction has been expressed by drivers of 'buses and cars with the improved and more even illumination of the road surface.

Three images of each lamp are shown on the mirrors, and anyone approaching the lantern sees apparently four times as many lamps as there are, or, with a three-lamp fitting, there are apparently twelve lamps, and it is only when the observer gets close under the post that he realises this.

The actual results of photometric measurements taken in the streets are shown in fig. 10, in which curve "A" shows the candle power at various vertical angles, and it will be noted that the candle power derived from three 150-watt lamps reaches 1,270, while curve "A'" shows the horizontal illumination on the ground level as measured in Katharine Street, and it will be noted that the illumination does not fall below 0.258, a standard only obtained in such streets as Regent Street and Whitehall. The maximum illumination being 0.87, gives the exceptionally low diversity factor of 3 to 4.

Curve "B" is for the three 100-watt lamps giving up to 1,100 c.p. over a slightly narrower angle, as in this case the lamps are lower and spaced at greater distances, the minimum illustration reaches 0.057 foot-candles, which is a high standard for this class of road. Curves "C" and "D" are for the single 75-watt lamp fittings used at 11 ft. high in the less important streets; it will be noted that the candle power reaches 260 and 230 with clear and sprayed lamps respectively. Curve "E" shows the result obtained with the four-light fittings used at cross roads.

It is hoped in the near future to adopt this type of lantern throughout the remaining main roads, and in the meantime further extensions with these lanterns are being put in hand.

Electricity at the Ideal Home Exhibition.

In our issue of January 16th (p. 89) we were able to reproduce a plan and elevation of the building which is being erected at the forthcoming Ideal Home Exhibition by the British Electrical Development Association. We have now received further details regarding the display which leads us to think that it will be almost as good as that at Wembley—and certainly better than we have seen at Olympia in previous years.

The structure was designed to the requirements of Messrs. Imrie & Angell,, architects,and is being built by Messrs. Beck & Pollitzer. The wiring is being carried out by Messrs. Troughton & Young, and the furnishing by Messrs. Arding & Hobbs.

The principal companies whose appliances will be exhibited are:—The General Electric Co., Ltd., Siemens Bros. & Co., Ltd., the British Thomson-Houston Co., Ltd., the Edison Swan Electric Co., Ltd., and the Metropolitan-Vickers, Electrical Co., Ltd., as well as a few other firms.

In addition to demonstrators who will thoroughly know their subject, the staff will include others who will be able to answer questions relating to the obtaining of a supply, the cost of using apparatus, &c.

A small formal garden with an electric fountain will be made up in the front of the house, and a welll-lighted entrance hall will lead into a combined dining-room and lounge in which heating, cooking, and lighting will be demonstrated in an appropriate manner. A door from this will lead into a bedroom which will provide opportunities for the display of further electric lighting effects and conveniences. As an annexe to the bedroom, a bath-room is being built, the principal feature of this being abundant supply of electrically-heated water.

The garage will house a central vacuum-cleaning plant, a refrigerator and a bench bearing examples of electrically-driven tools. The kitchen will be equipped with a modern type of cooking range, a water heater, a hot-cupboard, a labour-saving dresser, and a number of semi-portable cooking appliances. It is intended to demonstrate vacuum cleaning as well as cooking in this room. The scullery adjoining the kitchen will contain laundry plant, comprising a wash boiler, a washing machine and irons, as well as a dish-washer and means of cleaning boots and silver, and performing other drudgeries.

In addition to the main items, it is proposed to show a number of refinements and novelties, such as an electrical letter box which rings a bell upon the insertion of a letter, and a "cat-burglar" alarm.

In designing the house, the E.D.A. has had the benefit of extensive experience obtained at other exhibitions both at home and abroad, and has endeavoured as far as possible to reconcile the somewhat difficult conditions which must always exist where it is desired to show an actual house in being, and yet to pass crowds through it in such a manner that they may carry away really useful information.

To revive the impressions gained during a tour of the all-electric home, visitors will be provided with plenty of E.D.A. pamphlets which, as is well known, explain the advantages of electricity in a very clear manner.

There is no doubt that much good will result to the industry as well as to the visitors from this instructive series of exhibits.

Some Experiments on Contact Resistance and Heating of Plunger Type Lampholders.

By L. G. H. SARSFIELD, B.Sc., A.Inst.P.

With the increasing demand for electrical appliances in the domestic sphere, there comes the problem of suitable means for connection to the source of supply. At the present time electrical units, such as radiators, flat irons, vacuum cleaners, &c., are frequently supplied with power through plugs and sockets. This means that special power points have to be provided, and the apparatus can only be used where such points are found.

The provision of power points all over a house is expensive, and it is suggested that if the common plunger-type lampholder could be used more generally for currents above lighting ratings, electrical devices would be more readily adopted because of the possibility of connecting them to ordinary lamp fittings in any room.

Where plunger-type lampholders are at present in use for other than lighting purposes, overheating often occurs; in fact, cases of undue development of heat are still found where holders are simply supplying lamps. It was with these facts in view that the following experiments were carried out. "Tucker" plunger-type lampholders were used throughout.

Current was supplied to each lampholder from a low-voltage source and taken from each holder by a standard wooden adaptor connected to a variable resistance.

The familiar arrangement of the holder and adaptor is diagrammatically represented in fig. 1, which also shows the connections used for the volt-drop and heating tests.

Volt Drop Tests.

The ordinary type batten base was used and millivoltmeter flex leads were soldered on both poles of the holder as under:—

At A A′, *i.e.*, to the supply leads immediately outside the plunger sleeve blocks.

At B B′, *i.e.*, to the plunger sleeve blocks.

At C C′, *i.e.*, to the plungers.

At D D′, *i.e.*, to the screw terminals of the adaptor.

It was arranged that freedom of motion of the plungers was in no way reduced by their voltmeter leads which were brought out through slots drilled in the outer cylinders of the holders. The voltmeter leads of the sleeve blocks passed through similar holes suitably drilled. All the voltmeter leads were carefully insulated from all other parts, were cut all the same length, and chosen so that the volt drop due to them was smaller than the smallest value readable on the instrument.

Voltages were measured across A and B, A′ and B′, giving v_1 and v'_1 the drops at the set screw connections; across B and C, B′ and C′ giving v_2 and v'_2 the drops between the sleeve blocks and plungers; across C and D, C′ and D′ giving v_3 and v'_3 the drops at the contacts between the plungers and the adaptor. The voltages were also taken across A and D, A′ and D′ as a check upon the other readings. Values of voltage drop were observed at currents of 0.5, 1, 1.5, 2, 2.5 and 3 amperes. Two sets of observations were made similarly up to 6 amperes, and the values obtained made quite regular extensions of curves plotted up to 3 amperes for the same unit.

New Plungers, Sleeve Blocks and Steel Springs.

The first experiments were conducted with perfectly new units having springs of steel wire 0.02 in. in diameter wound into ten-turn helixes 0.67 in. long and 0.14 in. outside diameter.

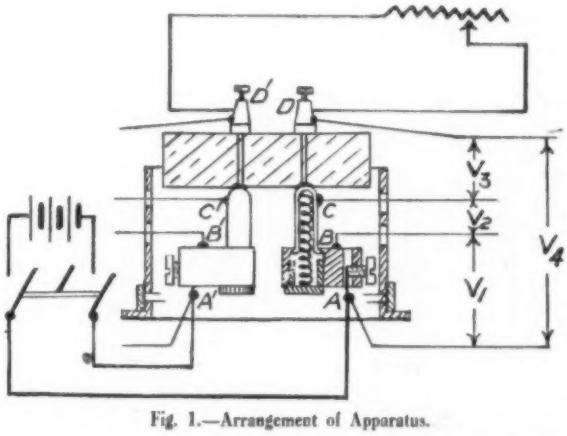

Fig. 1.—Arrangement of Apparatus.

The values obtained for these new parts and steel* springs are plotted (full lines) in fig. 2; all plotted values are the means of several observations on similar units and for both poles. Reversal of current gave no differences in voltage drops, hence in the graphs, fig. 2, "v′" values are plotted with "v" values.

Although the mean figures for new units have resulted in v_3 being greatest, v_2 intermediate, and v_1 least for any particular current, there were individual cases in these tests where v_2 exceeded v_3. This point was examined carefully, and the conclusion drawn was that mechanical contact between the plunger top and the adaptor was responsible in every case.

The points where greatest volt drops occur are (1)

*In the present type of Tucker holders phosphor-bronze springs are used instead of steel.

between the plunger and the adaptor, (2) between the sleeve block and the plunger. As will be demonstrated, the latter assumes great importance, and in fig. 2 the v_2 lines have been drawn in heavier than the v_1 and v_3 lines.

New Plungers, Sleeve Blocks and Insulated Steel Springs.

It was not known how the current, in passing through the holder, was being split up between the two parallel paths offered (1) by the contact of the sleeve block with the outside of the plunger, and (2) by the spring which was in contact with the inside of the sleeve block screw cap and the inside of the plunger.

In order to prevent the springs from carrying current, the insides of the screw caps were lined with paper. The plungers were similarly lined to insulate the springs. Another method used to make the current pass only through the contacts between the sleeve blocks and the outsides of the plungers was to employ "rubber springs." These were suitable lengths of rubber having circular section and chosen so as to allow of practically the same pressures being exerted by the plungers on the adaptors as with the insulated steel springs.

The results obtained under these conditions are shown by the short chain lines in fig. 2. The contact drop, for any particular current, is greatest between plunger top and adaptor, while, as would be expected, the drop at the entering lead is the smallest plotted.

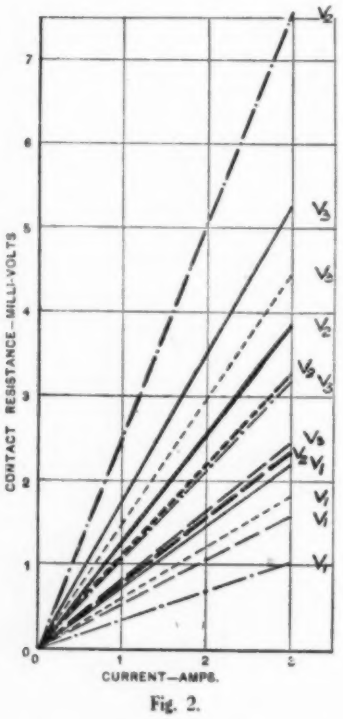

Fig. 2.

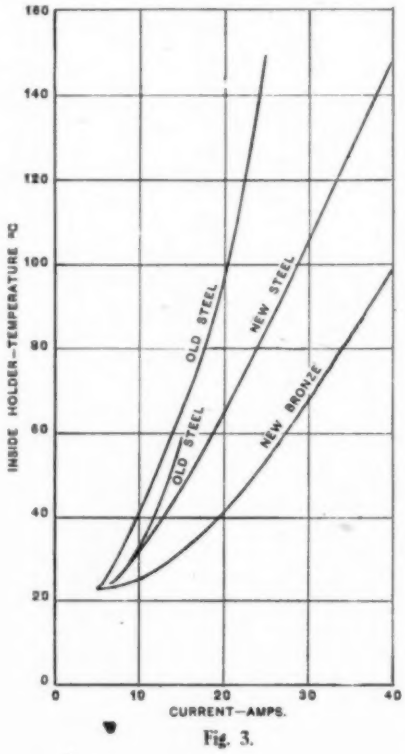

Fig. 3.

During this test a sudden open circuit developed. It was found to be the severing of contact between sleeve block and plunger caused by a jarring of the bench. This shows that in practice with this type of holder an open circuit (probably preceded by arcing and therefore heating) might develop if the spring and inside of the plunger became sufficiently oxidised to insulate them from each other.

Old Plungers, Sleeve Blocks and Old Uninsulated Steel Springs.

Oxidation, or the presence of poorly conducting films, on springs and plunger surfaces is noticed on inspection of old lampholders. Examination of units which had been in use for several years was made and mean volt-drop graphs plotted. Some springs were more rusty or duller than others (due to exposure in damp or acid-laden atmosphere) and the volt-drop figures for these showed definitely larger contact resistances.

In two cases steel springs were artificially aged by partial immersion in H_2S water. The results with artificially aged springs in old sleeve blocks were of the same order as with naturally aged ones, and were included when calculating mean values for plotting.

The values for these experiments are plotted with dot chain lines in fig. 2, which shows the significant fact that the contact resistance between sleeve block and plunger for old holders was the greatest recorded, and this indicates that much heat generation may be accounted for at this point.

New Plungers, Sleeve Blocks and New Bronze Springs.

Only new bronze springs were available, and so the behaviour of old ones was not investigated. It may be assumed, however, that bronze would not suffer from surface oxidation to the extent that steel would. The springs used in this set of tests were of bronze wire 0.02 in. in diameter wound into thirteen-turn helixes 0.92 in. long and 0.14 in. outside diameter.

The long chain lines in fig. 2 show the volt-drop between sleeve blocks and plungers for bronze springs. The v_2 line of this set is the lowest of all the v_2 lines and, incidentally, slightly lower than the v_3 line which represents the drop between the plunger and the adaptor for the same arrangement.

The springiness of the bronze was inferior to that of the steel, and after depressing the plungers of a holder carrying bronze springs by fitting an adaptor in the ordinary way, the springs were observed, upon removal, to have taken permanent sets.*

A comparison of the resistance and current-carrying capacity of steel springs with the resistance and current-carrying capacity of bronze springs may be mentioned here.

The average resistance of the steel springs was 0.101 ohm, and that of the bronze ones 0.078 ohm.

A number of steel and bronze springs were arranged in series, each being soldered to copper wire 0.064 in. diameter so as to make a continuous circuit, having alternately copper wire and spring. This "chain" was suspended in free air. Current, commencing with one ampere, was passed through this circuit, rising half an ampere at a time, and remaining at each value until conditions (indicated by colour, distortion and temperature) were apparently steady, before proceeding to the next. The steel springs were obviously always hotter than the bronze ones with any given current, and with three amperes the centre turns of the former took a blue colouration and became partially annealed. The end turns of each spring were cooled by conduction along the copper to which the spring was soldered. At four amperes the steel specimens were completely softened, and the bronze ones were softening. At four-and-a-half amperes the steel springs reached dull red heat in the middle, and the bronze became distorted and discoloured. Bright red heat was reached at five amperes by the steel, and at nine amperes by the bronze springs.

Heating and Destruction Tests.

Several old units with old steel springs were run to destruction without temperature measurement. To obtain curves relating temperature rise to current, the holders were set up in free air at ordinary temperature. In each case a thermo-couple (copper Eureka) was introduced through a hole specially drilled in the outer cylinder of the holder to allow the hot junction to be

* Allowance is made in Tucker holders for this closing up of the spring so that it does not affect normal working.

centrally disposed between the two plungers. The temperature recorded for any given current was taken as that value corresponding to a micro-ammeter reading, which when reached showed no readable increase for five minutes.

For currents less than five amperes the readings of the micro-ammeter were unreliable. A more detailed investigation of conditions for currents under five amperes would be useful, but the values obtained indicate the order of the characteristics for the units tested, and show their behaviour up to destruction point. The performances of the various kinds of spring are shown in fig. 3.

The new bronze spring is clearly the best large current carrying proposition, and the effect of ageing is demonstrated by the difference in slopes of the curves for new and old steel springs. The top ends of the curves are the points at which destructive conditions in the holders were evidenced by unsteady readings on the micro-ammeter and by "clicking noises."

Examination of each spring, after the destruction point was reached, showed discoloration and distortion. There is no doubt that destruction by ageing at earlier stages than those obtained would have occurred if current had been maintained constant instead of increased after apparent steadiness. The comparison of the curves is, however, instructive, and demonstrates in confirmation of previous results the advantage of new bronze springs over new steel ones, also the decreased efficiency of old units.

The heating tests gave encouragement for the opinion that plunger type holders might with certain improvements be used for currents greater than those to which they are at present restricted, but always within the limit set by the external contact, the plunger, and the adaptor.

Conclusions.

The results point to the use of bronze springs instead of steel ones for the existing design of plunger on account of better conductivity and smaller likelihood of surface oxidation, and consequent increase of contact resistance inside the plunger. It is remembered, however, that steel springs have better mechanical properties which secure a small advantage over bronze.

In the holders tested, the open end of each plunger is slightly belled outward, forming a flange.

When the spring urges the plunger fully outwards this flange meets the inturned rim of the sleeve block, and so the escape of the plunger is prevented. The fit of the plunger in the block is so loose that it is possible that no contact may exist between them except by means of the spring inside—this was shown in experiments with "insulated springs." If, at the same time, the condition of the spring is such as to give a high-resistance path for the current, heating must result.

If, however, the plunger were made with a cylindrical extension carrying a shoulder to take the place of the present flange, a fair sliding fit could always be maintained between this cylindrical portion of the plunger and the sleeve block so that good contact would result independently of the spring. Such an arrangement would be a little more expensive, but current carrying capacity would again be only limited by the external contact between the plunger top and the adaptor.

Acknowledgments and thanks are due to the governors of the Merchant Venturers' Technical College, Bristol, and to Prof. D. Robertson, D.Sc., for facilities offered in the electrical engineering laboratories; to Messrs. J. H. Tucker & Co., Ltd., Birmingham, for the generous supply of lamp holder parts, and to Mr. L. S. Lee, B.Sc., for his assistance in the experimental work.

Wireless Receivers with Crystal Detectors.

By THOMAS CARTER.

It would be interesting to know whether others have had the same experience as I have had with crystals any crystal detectors. My house is about two and a quarter miles from the Newcastle broadcasting station, 5NO, and I have a short inside aerial connected to a very simply-put-together crystal set wtih variometer tuning and no variable condenser. I have a fixed condenser in parallel with the headphones; I think it gives very slightly clearer reception, but the effect is small. The crystal and headphones are in series directly across the variometer terminals; that is to say, the circuit is of the most elementary kind. I get excellent results, using up to four sets of headphones in parallel. With one set only in use, the reception is often too loud to be what I consider comfortable; the addition of a second set reduces the strength slightly, but the addition of the third and fourth sets makes practically no further difference.

I am not able, it is true, to hear the chimes of Big Ben, as some say they do, when the headphones are hanging at one side of the room, and I am at the other; nor do I want to hear them so. All I want is clear transmission with the headphones in the place they were designed for. There are, it need hardly be said, people here, as elsewhere, who report all manner of unusual results: Chelmsford as easily as 5NO; Paris time signals; London; and so on, all with a simple crystal set. A local scoffer has Limericked these listeners thus:—

Some men in Northumberland dwell,
Who, with pride, of their crystal sets tell
How, direct, they give London's
Broadcast in abundance;
It's a lie, but it sounds rather well.

(There is an alternative last line, ending with a reference to the lower regions, which you would not care to print.) There are frequent recommendations of this, that, or the other kind of circuit, with loose coupling, with only a certain specified diameter of wire used in it, with a little tuning capacity, with a wave-trap for Cullercoats (which, incidentally, and fortunately, I never hear when 5NO is broadcasting, although I can always hear it a little when nothing else is on), and so on. What I should like very much to know is whether any one or other of these things really makes any difference worth having, when the object of the set is mainly to listen now and again to things of interest. My own answer to such recommendations is, for myself: I am getting all I want; why should I spend time in making problematical improvements, when I have little time to spare? But that, I must be the first to admit, is not very scientific; does anyone know a better answer?

I have tried several different types of crystal detectors and several different brands of crystals. I started with a very simple type of zincite-bornite Perikon, which gave very stable results but was difficult to adjust again to its best if anything disturbed it once in a while. I next tried, as an alternative, a detector that cost twice as much as any other I have, said to be more sensitive than most others, and absolutely stable; it is the only one that I have that is really of no use at all. (This, I believe, is as much bad luck as anything, for I know someone else, rather nearer the broadcasting station than I am, who uses a similar detector successfully.) After this, I went over to the cat's-whisker detector, and I must say that I find that type at least as stable as any, and very easy to readjust

should occasional attention be required. A few months ago I substituted for zincite in my Perikon a piece of another material that I saw advertised, and I found it better than the piece of zincite I had been using (that is all the comparison I can make); but even then it is certainly no better than the cat's-whisker combination. I have tried four kinds of " all-over-sensitive " crystal, each with a fancy name, and each looking, at least, very much like the rest; and I cannot find any difference between them. I see, in the advertisements of some of them, letters from users who say that they have never had such results before. Very probably their distance from their station is greater than mine from mine; but, frankly, it would interest me very much to know what kind of crystal these people were using before. The conclusion I have come to is that there is nothing to choose between the crystals sold under fancy names, usually at what seems like a fancy price; they are all good, and any one of them will give excellent results. Nor do I find any difference in reception, where I am, between cups with Wood's metal, cups with screw-down caps, and cups with side-screws. I prefer those with side screws for purely mechanical reasons, because they expose a rather greater surface of crystal than the others, and they afford a slightly simpler fixing for the crystal; but that is all. I recently bought a detector, newly on the market, I believe, with a micrometer adjustment, in addition to the usual swivelling ball, so arranged that the cat's-whisker feeds forward without turning round. This gives, I have found, results perhaps approaching five per cent. better than the ordinary type without a micrometer, because of the very nice adjustment that is easily possible. On the whole, however, my view that equally good results can be got from any well-made detector, containing any one of the well-known crystals is unchanged.

What I have in mind as the ideal detector, except that it might perhaps be a little more costly than others that, as I have said, give first-class results, is one with a glass enclosure for the crystal securely held between two end-plates by screws, quite independently of the mounting of the combination. At one end there would be a swivelling ball, mounted permanently on the end-plate so as to be really stable in position once it is set (the only trouble I ever had was due to the slackening of the clamp of a swivelling ball), and having a micrometer adjustment through it, with a well-fitting screw, arranged to advance the cat's-whisker without rotating it. At the other end there would be a cup for the crystal, easily removable from the outside of the combination, and not requiring the dismantling of all the other parts to get it out; and provision should be made for the use of any type of cup—Wood's metal, screw cap, or side screw. (This necessitates a glass enclosure of rather larger diameter than is usually provided.) The whole rigid combination that I have just described, containing cat's-whisker and crystal in a glass cell with end-plates that will not collapse when it is taken out of its supports, should then be mounted in spring clamps or in some other holders connected to terminals as usual. For anyone interested in comparing different crystals, such a detector would be of great value; and apart from all experimental interest, its rigidity and mechanical stability would tend to give the most stable results in its actual use for reception because of the invariability of contact between cat's-whisker and crystal that would be secured. With a little contrivance, the detector could be arranged so that the whole of the cat's-whisker gear could be extracted from one end, just like the cup at the other end, and a Perikon fitting could be inserted instead. The great thing seems to me to be to design the detector so that the essential parts can be handled under all conditions without their coming into a lot of little pieces, as happens in several of even the best detectors available now.

Crystal sets will probably be more and more used as the country becomes more completely covered by broadcasting stations, and anything that will make the good still better is valuable.

Feed-Water Treatment.

The Use of Colloids.

In a paper read before the INSTITUTE OF MARINE ENGINEERS by Messrs. W. B. Lewis and G. S. Irving, M.I.Ch., on February 3rd, the authors deal with the application of colloidal chemistry to feed water problems. Colloid means " glue-like " and a colloidal solution is one in which a finely divided substance does not coalesce. The small particles in this solution are " colloids "; they are larger than molecules, but very small compared with visible particles, *e.g.*, particles of dust in air. The majority of colloidal particles have an electric charge. The determination of the source of the electrification of any colloid has not yet been made, but research would point to *ad*sorption of either positive or negative ions. The conducting power of electrolytes, *e.g.*, salt, soda, &c., is well-known to be due to their dissociating in solution into positive and negative ions, and in passing, perhaps it should be explained that the word " ions " refers to an atom possessing an electric charge. The difference between a colloidal particle and an ion is that in the former the molecules carry the electric charge, and in the latter, the atoms. The difference between absorption and adsorption may be illustrated as follows :—

Imagine a thick piece of blotting paper on to which is poured some dirty water. The water is *ab*sorbed by the paper—the dirt only partly penetrates the surface or is *ad*sorbed. So long as the charge remains on the colloidal particles, they repel one another, and do not coalesce. Positive ions precipitate negatively-charged colloids, and negative ions precipitate positively-charged colloids.

The electrical methods which are employed for the removal of oil from condensates consist in an application of colloidal chemistry. The oil particles have on them an electric charge due to adsorption of inorganic salts present in traces, and when a current of electricity is passed through them they travel to the pole opposite to their charge.

A colloid is precipitated by passing an electric current through a solution of it. The colloid is precipitated at the pole having an electric charge opposite to that on the colloid. Colloidal iron is a yellowish brown solution, and is a convenient substance for demonstrating how the electric current deposits it on the negative pole, changing it into ordinary hydrate of iron. A substance called algor is used in the colloidal treatment of feed waters; this is deposited as a jelly or (gel) on the positive pole, showing it has a negative charge. If soda is put through a similar test it will be found to be non-colloidal.

Gum and gelatine are often used to stabilise emulsions, especially in pharmacy, such as cod liver oil emulsion. The gum acts as a protective colloid around each particle of the oil, and prevents it from separating out.

To treat the water with soda or the like is to produce a chalky deposit in the boilers. It is much the better plan to allow the scale salts in the water to form a colloidal jelly by the addition of a protective colloid, especially if the gel so formed is capable of absorbing suspended matter, and retaining moisture at elevated boiler temperatures. Instead of a crystalline deposit, there is a flocculent precipitate with this colloidal treatment, which is easier to deal with.

Some interesting figures are given in the paper as to the quantities of salt, &c., found in the Thames. It is interesting to note the variations at high and low tides. An analysis of the River Thames water at Egham shows :—

	Grains per gallon.
Silica	0.23
Sulphate of lime	0.22
$Ca\ Co_3$	17.20
Sulphate of magnesia	1.32
Nitrate of soda	1.78
Sulphate of soda	1.99
Salt	2.87

Total hardness, 18.50.

The Thames at Vauxhall, like most other rivers, varies according to the ebb and flow of the tide. As an instance :—

High Tide.	
Total hardness	15.80
Salt	8.60
Sulphate of magnesia	2.52
Low Tide.	
Total hardness	16.35
Salt	3.27
Sulphate of magnesia	1.86

Electricity in Linen Manufacture.—Messrs. J. & T. Alexander, Ltd., linen manufacturers, Canmore Works, Dunfermline, have just completed a year's experiment in the running of their works by electrically-driven machinery, and the change-over is reported to have given the utmost satisfaction. The workers are stated to have benefited by the change, especially those engaged in the ironing department, where the irons are now heated by electricity instead of gas. The installation of individual electric lights over each loom has helped in the production of a better class of goods, while another advantage is the decreased space required by the new machinery. The power is supplied by the Fife Electric Power Co. from its Townhill station.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

The Radio Manufacturing Industry.

I read with great interest "Alec's" letter in last week's REVIEW; taking into consideration the way the "wireless" trade has been thrown out for anybody to take up, instead of being kept to the electrical trade to which it rightly belongs, perhaps to have got a better hearing for his plea to buy British goods "Alec" should have written to the "hairdressers'," "confectioners'," and "musical" journals.

As an electrical contractor, I employ all-English material, and whenever a "foreign" agent has paid me a visit I have shown him the door, as the sound of his voice brought back memories of Flanders, but "a little" foreign goods may now be found in my shop for the simple reason that I cannot stand the delay and muddle our own firms put us to with the delivery of goods ordered.

With regard to the plea for friendly co-operation, I should like to ask why it is that, after wiring a house, when I ask the new owner about the fittings I get: "Oh! I can get them 'trade' myself; I have a friend in it"? Why can anybody have a card printed and go and get what he likes at "trade prices"? Why am I denied advertising matter for an English battery which I deal with, when the local garage can have it? Is this fair play or a square deal that "Alec" asks us contractors for? Apparently any employer of our large houses can buy what he likes at "trade" and supply his friends or the maid's distant relations.

May I conclude by assuring "Alec" that I am wholly with him in supporting our own industries, as at present I am listening to St. Martin's service through my home-made valve set built up entirely of English parts, but for the "deal" to be square let the manufacturers consider us as part of the electrical family and keep the trade to the trade instead of branding it "anybody's."

A. T. Phillips.

Harpenden, *February 9th*, 1925.

Visible Bonding.

The visible bonding of flat metal-sheathed surface wiring systems demanded by "Electron" last week is already available. One method of visible bonding was described in the ELECTRICAL REVIEW three or four years ago in connection with the Ediswan system, and another method is employed in the wiring system quite recently put on the market by Messrs. W. T. Glover & Co., Ltd., of Manchester, and described in the ELECTRICAL REVIEW of October 24th, 1924, both methods having been suggested to the firms in question by the present writer.

F. Charles Raphael.

London, *February 6th*, 1925.

Lead-covered Wiring.

Much has been discussed in your columns from time to time regarding various systems of wiring, to which discussions the writer has contributed under the *nom-de-plume* of "Contractor's Foreman." I am prompted again to raise this matter due to further experiences regarding the Henley system of metal-sheathed cable and in fairness to Messrs. Henley's.

It appears to the writer that much apathy exists in regard to the lead-covered wiring system, and in my opinion, it is due to scamped work; the cable of course cannot be in any way to blame. If properly installed and if the proper accessories are used, *i.e.*, boxes, &c., I have every confidence in this system of wiring. Where faults have arisen I have found them to be due to a rough joint being made instead of a box being used to tap off to a light or switch, and no proper attention being given to bonding or earthing.

In occupied houses I have frequently put forward the lead-covered wiring system, and all jobs carried out under my supervision have given the clients entire satisfaction. On the other hand, in several places where I have put forward this system, the people have practically held up their hands in horror, and would on no account hear of any such system, stating that they had been told that fires, &c., had their origin in this system. This, in my opinion, is caused through bad workmanship, and it must be obvious to most people that no cable makers would turn out material which was likely to injure their reputation; in short, a good lead-covered wiring system makes a first-class installation if installed by competent electricians, and I hope to see this class of wiring coming into more general use in future.

Alexr. Milne.

Edinburgh, *January 25th*, 1925.

The Closure of Finsbury Technical College.

The closure of Finsbury Technical College, for lack of financial support from the City Companies and the London County Council, has been determined upon to take place at the end of the year 1926, and there seems little hope that the London County Council will reconsider its decision.

It will be remembered that, as a result of strong protests three years ago, the London County Council decided to support the institution for a further period, but it seems now to be an established fact that Finsbury Technical College can no longer attract a sufficient number of students desiring to advance their technical knowledge but having no anxiety to obtain University degrees.

The passing of any institution of this kind raises inevitably the question of the future of the staffs engaged. While any institution threatened with closure remains open staffs must be maintained, and men who have served long and faithfully the cause of education should not, like their institution, be regarded as superfluous or redundant. Unfortunately there is no indication in the attitude of the London County Council that as yet that body has considered the position of the staff, and has made any provision for their subsequent employment. Accordingly, at the annual council meeting of the National Union of Scientific Workers held on January 31st, the following resolution was put and carried unanimously:—"In view of the fact that the closure of the Finsbury Technical College is a certainty, the London County Council is urged to make provision for the absorption in other institutions, with seniority, of those members of the staff who will be on the staff when the college closes."

Copies of this resolution are being forwarded to the Chairman of the London County Council Education Committee.

A. G. Church,
General Secretary,
National Union of Scientific Workers.

London, *February 7th*, 1925.

Mr. C. H. Wordingham and Registered Contractors.

In the appreciations of the late Mr. Charles Henry Wordingham which have appeared in the electrical Press, little or no reference has been made to the services that he rendered to the contracting section of the industry.

To have been Chairman successively and so successfully of two such "difficult" committees as those which evolved the Wiring Rules for Ships and the Wiring Rules for Buildings, was in itself no trifling test of endurance in good works.

In connection with the National Register of Electrical Installation Contractors, Mr. Wordingham gave the most devoted attention as Chairman, not only of the Board, but of the Executive Committee.

To this, the latest and not the least of the schemes for the good of the industry, he gave much patient labour. Registered contractors can only hope that his example may be followed by other chiefs of the Institution and in the same refreshing spirit of freedom from commercialism.

Donald S. Munro.

Edinburgh, *February 6th*, 1925.

Business Notes.

Bankruptcy Proceedings.—WM. SINCLAIR TAYLOR, 20, Redcliffe Square, Kensington, and "Earlswood," Winterbourne-Gunner, near Salisbury.—An application for an order of discharge was made on **February 3rd, at the London Bankruptcy** Court, on behalf of this bankrupt, who failed in December, 1923. Mr. Vincent Armstrong, Official Receiver, reported that the ranking liabilities amounted to £9,446 and the only asset disclosed was a bad book debt for £3,200, from which nothing could be expected for the benefit of the creditors. The discharge was opposed by the Official Receiver on the following grounds:—(1) Insufficiency of assets to equal 10s. in the £ on the amount of the unsecured liabilities; (2) Contracting a debt provable in the bankruptcy without reasonable or probable ground of expectation of being able to repay it; (3) Contributing to the bankruptcy by unjustifiable extravagance in living and by rash and hazardous speculations; and (4) Putting several of his creditors to unnecessary expense by a frivolous defence to actions properly brought against him. Mr. Registrar MELLOR said he was satisfied that it was a very bad case indeed. The bankrupt throughout his career of a lamp merchant had been endeavouring, in one disguise or another, to infringe British patents, and to a point he had been successful. Then he carried on business in his wife's name, putting her forward as the principal, and when it came to the issue of debentures by his company he took them in the name of a nominee, and, as he had said, he did it deliberately in order to fight what he called "the ring." An injunction was granted against his wife in 1922 and ever since then the bankrupt had been trying to get round it. The bankruptcy called for a very substantial period of suspension and the order would be one of five years from date.

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E. P. HIGGINS (Western Union Wireless Co.), 99, Regent Street, W.—Receiving order made January 28th, on creditors' petition. First meeting, February 11th. Public examination, May 8th; both at Carey Street, W.C.

G. H. DIXON, electrical contractor, 4, Woodville Road, Dewsbury, carrying on business at 46, Market Place, Dewsbury.—Receiving order made at Dewsbury County Court on January 31st. First meeting, February 17th; public examination, March 5th, both at the County Court House, Dewsbury.

R. HAWORTH, lately trading at 154, Duckworth Street, Darwen, as an electrical engineer.—The public examination of this debtor was held at the Blackburn Bankruptcy Court on February 4th. The liabilities amounted to £872 and the assets to £162, the deficiency being £659. Debtor was formerly a journeyman electrical engineer. He commenced business in May, 1924, with £50 capital. He had never made any profit. He took £3 10s. a week out of the business for personal and living expenses. Bad trade and taking on work at too cheap a rate were given as reasons for his insolvency. The examination was closed.

F. P. CRAWLEY, New Central Garage, 30, Mincing Lane, Blackburn, electrical, radio and motor-car engineer.—The adjourned public examination of this debtor was held recently at the County Court House, Blackburn. The Official Receiver said that the debtor's deficiency account was unsatisfactory. He was ordered to supply a deficiency account showing his income and expenses, and the case was further adjourned.

Company Liquidations.—WEST LANCASHIRE ELECTRICAL CO., LTD.—Winding up voluntarily. Liquidator, Mr. J. A. Bond, Hoghton Chambers, Southport. Meeting of creditors, February 16th, at the offices of Messrs. Davies & Crane, Hoghton Chambers, Southport. Particulars of claims to be sent to the liquidator forthwith.

MITCHELL'S ELECTRICAL & WIRELESS, LTD.—Last day for proofs for dividend, February 20th. Liquidator, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.2.

BARCLAYS RADIO STORES, LTD.—Winding up voluntarily. Liquidator, Mr. C. T. Appleby, 26, Corporation Street, Birmingham.

FORD ELECTRICAL CO., LTD.—Winding up voluntarily. Liquidator, Mr. J. F. Stott, 10, Norfolk Street, Manchester. Meeting of creditors, February 17th, at the Grosvenor Hotel, Deansgate, Manchester. Particulars of claims to be sent to the liquidator forthwith.

MORECAMBE TRAMWAYS CO.—Meeting of creditors, February 18th, at 62, Market Street, Lancaster.

DE MARTIS ACCUMULATORS, LTD.—Particulars of claims by March 2nd to the liquidator, Mr. C. A. Firth, 70, Lombard Street, E.C.

Trade Announcements.—THE D.P. BATTERY CO., LTD., has appointed MESSRS. KELSALL & PARSONS, 19, Blythwood Square, Glasgow, as its agents for Scotland, in place of Mr. William Scott.

Mr. S. CROSBY, who was for 12 years with the Marconi Co., has commenced business as a radio engineer at 16, Wilderspool Road, Warrington.

Mr. J. A. WALKER has been appointed manager of the Meta Manufacturing Co., Ltd., in place of Mr. O. Hauser, who has now left the firm.

The Wiring Supplies Department of the BRITISH-THOMSON HOUSTON CO., LTD., is being removed to-morrow, Saturday, from the old Mazda House, in Upper Thames Street, E.C., to the new Mazda House, at Newman Street, Oxford Street, W., which is situated at the junction of Oxford Street and Newman Street, and within a stone's throw of Tottenham Court Road. Telephone number: "Museum 9801." Telegrams: "Mazdalux, Westcent, London."

ROTAX (MOTOR ACCESSORIES), LTD., has appointed Messrs. E. Lander, Castle Garage, Luton, as its official service and battery agents.

Catalogues and Lists.—THE ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, W.C.2.—Publication No. 570, a reprinted article on geared steam turbo-generator sets.

THE MACINTOSH CABLE CO., LTD., Ashbourne Road Mills, Derby.—A series of illustrated pamphlets advertising "Maconite" cables—especially trailing cables for colliery use.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Price List No. 2251-B, dealing with d.c. motors up to 30 h.p.; Descriptive List No. 4471, describing "B.T.H." systems of protection for a.c. generators, transformers, and feeders; and Price Supplement No. 5021 and Descriptive List No. 5021-A, covering a.c. controllers and resistances for 2- and 3-phase slip-ring motors.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, Newman Street, Oxford Street, W.1.—An illustrated and priced catalogue of "Mazdalux" reflectors and "Glassteel" diffusers for industrial illumination.

MESSRS. BRUCE PEEBLES & CO., LTD., Edinburgh.—Pamphlet No. 13D, containing numerous illustrations and descriptive matter relating to the company's standard open type a.c. generators. A list of important buyers of these machines is included.

MESSRS. HICK, HARGREAVES & CO., LTD., Soho Iron Works, Bolton.—An illustrated brochure dealing with the construction of the company's steam turbines.

THE MIRRLEES WATSON CO., LTD., Scotland Street, Glasgow.—Pamphlet No. Pu. 780, illustrating and describing "Mirrlees" tube-well or borehole pumps.

THE ELECTRO-MAGNETIC TOOL CO., Chicago.—An illustrated folder advertising the "Speedway U.L.A." electric drill.

DELCO-REMY & HYATT, LTD., 56, Victoria Street, S.W.1.—Leaflet A.U.33, dealing with fan, pulley and rocker-arm mountings.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—February stock list of motors and dynamos.

MR. J. C. WHITE, 49, Bridge Street, Deansgate, Manchester.—An illustrated price list of corrosion proof portable hand lamps (Home Office pattern).

MESSRS. MAYALL & CO., LTD., 61, Moor Street, Birmingham.—Four blotters, each bearing a coloured picture and an advertisement of "Chakophone" radio sets.

THE RILEY STOKER CO., LTD., Palace Chambers, Bridge Street, S.W.1.—Catalogue "B," containing a number of illustrations of "Riley" stokers as applied in various undertakings.

SWITCHGEAR & COWANS, LTD., Elsinore Road, Old Trafford, Manchester.—Descriptive Section No. 13 dealing with current and potential instrument transformers for circuits up to 11,000 V.

MESSRS. EVERSHED & VIGNOLES, LTD., Acton Lane Works, Chiswick, W.4.—Fully illustrated 12-page descriptive catalogue of a 1,000-volt generator for radio transmission. The circuits described in the booklet have all been tested under ordinary amateur transmitting station conditions.

MESSRS. WATSON & SONS (ELECTRO-MEDICAL), LTD., Sunic House, Parker Street, Kingsway, W.C.2.—A very comprehensive illustrated and priced catalogue of X-ray generators and accessories, and means for applying radium.

Social Events.—The annual concert promoted by the Bradford City tramway employés was given at St. George's Hall on February 4th, when the artistes were Miss Phyllis Lett, Miss Olive Jenkin, Mr. Walter Widdop, Mr. Joseph Farrington, and Mr. Will Kings. Music was provided by the Bradford City Tramways Military Band, under the conductorship of Mr. V. Calverley. The accompanist was Mr. Shackleton Pollard.

The staff of LE CARBONE held its annual dinner on January 29th. This was followed by a concert, which was continued until a late hour.

The first annual dinner of the management and staff of the English Electric Co.'s Aircraft Department was held at Preston on February 6th. Mr. E. Gibson Knight (manager) referred to the success of the P.5 Kingston flying boat, and the high hopes he had for the future of the machine. He said that since 1911 some 1,500 machines, from 3 h.p. to 2,400 h.p., had been constructed by the department.

For Sale.—Ayrshire Electricity Board has for disposal surplus plant including one 750-kW and one 500-kW turbo-alternators, with condensing plant, several generating sets, &c. Nottingham Corporation electricity department invites offers for the whole of the steam generating plant at the Talbot Street station. Cardiff Corporation electricity department invites offers for three 300-kW Belliss & Morcom-Siemens alternators, condensing plant, pumps, four water-tube boilers, &c. Wigan Corporation Tramways Committee has for disposal a quantity of scrap metal lying at the Central Tramway Depôt. (See our advertisement pages to-day.)

British Trade-mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 4th. In the case of foreign applications, the names and addresses of the British representatives are also given:—

Sonora, The Instrument of Quality, Clear as a Bell (lettering and design). No. 447,760. Class 8.—Instruments and apparatus for use in wireless telephony and telegraphy, combination phonographs and wireless receiving sets. Sonora, Inc., 279, Broadway, New York. (White, Langner, Stevens & Parry, 88-90, Chancery Lane, London, W.C.2.)

Volutone. No. 448,444. Class 8.—Loud speakers, being instruments for use in wireless telephony. Fellows Magneto Co., Ltd., Willesden, London, N.W.10.

Alphatone. No. 453,400. Class 8.—Instruments and apparatus and parts thereof for use in wireless telephony and telegraphy. Steels & Busks, Ltd., Temple Road, Evington, Leicester.

Dulcevox. No. 453,712. Class 8.—Apparatus for use in wireless telephony and telegraphy. The Edison Swan Electric Co., Ltd., London, E.C.4.

Safe-T-Stat (lettering and design). No. 454,347. Class 8.—Thermo-electric temperature indicators. The Safe-T-Stat Co., 785, Drexel Building, Philadelphia. (Johnsons & Willcox, 47, Lincoln's Inn Fields, London, W.C.2.)

Interzone. No. 450,832. Class 13.—Electric lampholders, electric switches, and other electrical fittings. H. Marryat, trading as Marryat & Place, London, E.C.1.

London Electricity Supply Bills.—The London Electricity Supply Bills (Nos. 1 and 2), the County of London E.S. Co. Bill, and the North Metropolitan E.P.S. Co. Bill were down for reading on February 10th, but, being objected to, were held over until February 12th.

Traders and Municipal Trading.—In connection with forthcoming demonstrations of certain makes of electrically-driven meat choppers and coffee mills, the Bradford Corporation Electricity Department wrote to the Chamber of Trade inviting the co-operation of local traders in testing the appliances and offering to send a showroom representative to interview the Traders' Association. The Chamber of Trade referred the department to the Grocers' Association. The committee of the latter, on February 3rd, decided to take no action, on the ground that it regarded the department's activities as municipal trading, of which the association did not approve.

Book Notices.—"Technical Conference of State Utility Commission Engineers, March 2nd and 3rd, 1923." (80 pp.) Washington: Government Printing Office (for the United States Bureau of Standards). Price 15 cents.—This is a complete report of an American conference corresponding in many ways to the annual meeting of the I.M.E.A. A number of technical and adminstrative matters were discussed.

"Faraday House Journal." Vol. XI, No. 2; Lent Term, 1925.—This issue contains an article by Mr. H. H. Munro on the (Emmet) "Mercury Vapour Process," in addition to reviews and the usual notes and notices.

"The Platinum Metals," by E. A. Smith. Pp. xii+123; figs. 35. London: Sir Isaac Pitman & Sons. Price 3s. net.

"Technologic Paper of the United States Bureau of Standards, No. 266"; "Measurement of Heat Insulation and Related Properties of Blankets." Washington: Government Printing Office. Price 10 cents.—This describes an electrical heating method of determining the properties mentioned in the title.

Scientific Paper No. 265 of the United States Bureau of Standards. "Theory and Performance of Rectifiers." (63 pp.) Washington: Government Printing Office. Price 20 cents.—This is an illustrated description of an investigation into the performance of small rectifiers used for charging batteries, including aluminium and tantalum electrolytic, thermionic, and vibrating rectifiers, and in order to explain the results obtained, it was necessary to develop the theory of rectification as it occurs during the process of battery charging. The degree of rectification and energy efficiency of the electrolytic type were increased by using high current densities and inductance in series; their performance curves are very similar in shape to those of the ionised-gas rectifier, although, of course, their numerical relations differ. The relation between power output and battery voltage may be represented by an equation from which the battery voltage for maximum output may be computed. The performance curves of the vibrating rectifiers are similar to those of the electrolytic type; the battery voltage for maximum output, however, cannot be so readily calculated because the vibrator required considerable time to operate at each reversal of the alternating voltage.

"The *Journal* of the Junior Institution of Engineers." February. London: Percival Marshall & Co. Price 2s. net.—In this issue are reproduced Dr. Alexander Russell's presidential address; a paper by Major A. M. Taylor on "The Hexaphase System and the Compensated Three-Phase System for 150,000-V Transmission, with Records of Tests"; and "Some Notes on Metal-Cutting under Water by means of a Blowpipe and a Jet of Oxygen," by Mr. J. B. Pollard. The Journal contains numerous notes of interest to members.

The Ideal Home Exhibition.—We have received from the organisers of the Ideal Home Exhibition, which is to be held at Olympia from March 2nd to 25th, a brochure drawing attention to some of the principal features of this year's show. We are surprised to find, however, that there is no direct reference to the display which is being arranged by the British Electrical Development Association.

Advertising.—At a Salesmanship Conference held under the auspices of the North-East Area Sub-Committee of the British Electrical Development Association on January 22nd at Sopwith's Lounge, Newcastle-upon-Tyne, Mr. T. C. Elder spoke on "Advertising—the Handmaiden of Industry." He said that suggestion was far more powerful than argument in the designing of advertisements. In salesmanship, too, the best weapon was, in many cases, suggestion. In calling upon non-consumers or under-consumers, the canvasser would often gain more ground by emphasising that electrical service was being rapidly adopted in all the best houses than by elaborate attempts to calculate costs in detail. He thought that in their advertising, supply authorities were inclined to expect too much from the circulation of one leaflet or pamphlet. There was not enough regularity and persistency in addressing the prospective consumer. Mr. Elder mentioned the work of the E.D.A. as exemplifying community or collective advertising, and said that the work of E.D.A. in national electrical propaganda ought to be strongly supported. The speakers in the discussion that followed were Messrs. Pinkney, Gledson, Smith, Edgar, Pike, and Horsfall.

American Mineral Exports in 1924.—The total exports from the United States of metallic and non-metallic minerals, including ores, metals, and manufactures, excepting machinery and vehicles, amounted to $961,511,591 during the first 11 months of 1924, an increase of $46,027,334 over those of the same period of 1923. The exportation of copper and its products increased **$24,144,684 in value during the 1924 period** under review compared with the corresponding months in 1923; aluminium, $979,790; bauxite, $252,225; lead, $4,615,147; and zinc, $567,567. The increase in the exports of these minerals and metals is indicative of the industrial revival in Europe. With the countries of the Continent becoming more and more stable financially, the American producer and manufacturer may look forward to an even larger share of his products being absorbed abroad.—*Commerce Reports.*

Tramway Strike Ended.—The strike of 300 vehicle workers employed at the Hendon repair depôt of the Metropolitan Electric Tramways, came to an end on Monday last, the men agreeing to return to work pending an inquiry into their wage grievances. If the strike had continued it would have involved the motormen and conductors of the tramways.

Scottish Electricians' Wages.—The semi-skilled and unskilled workers at the Perth electricity works are to have their wages increased by 5s. per week.

The Glasgow Corporation Conditions of Service Committee has agreed to give effect to an increase of 1½d. per hour to skilled electrical workers.

French Electrical Exports and Imports.—A French correspondent of the *Manchester Guardian Commercial* states that the exports of electrical goods from France during the first half of 1924 showed a notable increase upon those of the first half of 1923. The French Customs returns record that the exports during the first six months of last year amounted to 100,852,000 quintals, valued at 190,768,000 fr., as compared with 83,260,000 quintals (127,691,000 fr.) in January-June, 1923. The principal increases occurred in the following cases:—Dynamos and transformers, from 11,688,000 quintals (13,091,000 fr.) in 1923 to 19,210,000 quintals (29,285,000 fr. in 1924; electrical fittings, from 16,879,000 quintals (56,207,000 fr.) to 23,120,000 quintals (95,061,000 fr.); and porcelain and insulators from 6,653,000 quintals (2,661,000 fr.) to 11,409,000 quintals (4,999,000 fr.). On the other hand, there was a decided fall in the exports of carbons, wires and cables.

The imports show a reduction in nearly all sections, except incandescent lamps, which rose from 1,687,000 quintals (11,509,000 fr.) to 2,666,000 quintals (23,972,000 fr.); accumulators and parts which increased from 1,968,000 quintals (1,009,000 fr.) to 3,080,000 quintals (1,658,000 fr.); and porcelain and insulators which rose from 3,285,000 quintals (1,410,000 fr.) to 8,201,000 quintals (5,620,000 fr.). A study of the above figures reveals that the price per unit weight, both of exports and imports, rose all round.

The Turkish Electrical Market.—A French official report gives some particulars regarding the openings that exist in Turkey for electrical material. As regards dynamos and machinery there has been practically no import except to supply the requirements of the company which holds the concession for the supply of electricity in Constantinople. More important is the market for fittings for electric light for domestic use and incandescent lamps. Purely industrial material does not, at the present moment, possess any interest for Constantinople, although the Government has certain projects under consideration which will conceivably alter this state of affairs. The Constantinople Electricity Company is extending its system and endeavouring to interest its customers in electrical appliances which are sold or leased at low rates. In Constantinople the wiring is entirely enclosed in tubes, whilst bayonet-jointed lamp sockets are never employed. The motors most in demand are 190-V, 50-cycle, 3-phase machines, of from 1 to 60 h.p. Single-phase motors are confined to fractional horse-powers. Practically all the porcelain insulators used are obtained from Germany.

Birmingham Undertakings and Rate Relief.—The Finance Committee states that the rates of Birmingham cannot be kept at their present level unless a substantial contribution from profits is made to the relief of the rates by the Electric Supply, the Gas and Tramway Departments. Last year these departments gave, collectively, £100,000. This year, owing to heavy expenses and other difficulties the Gas and Electric Supply Departments declare that they cannot make a contribution. A keen controversy has arisen and negotiations are being continued.

Lectures on Export Trade.—An interesting feature of the work of the British Export Society, which has been formed to encourage interest in and to promote export trade, is that monthly addresses concerning oversea markets and other matters relating to export business are delivered to the Society. At a recent meeting of the Society an address was delivered by Mr. A. C. Rouse, Head of the American Section of the F.B.I. Mr. Rouse emphasised the importance of studying the climatic conditions of oversea markets. Tariffs, in Mr. Rouse's opinion, were imposed by the countries of Latin America more for revenue than for protective purposes and he did not anticipate that the growth of local industries would be harmful to British industries, except in Brazil and in isolated lines in other countries. Mr. Rouse concluded with a few remarks about the influence of the United States, which had been considerably extended, especially on the West Coast, as a result of the opening of the Panama Canal.

Callender's Hospital Fund.—The accounts of the Hospital and Distress Fund of Callender's Cable and Construction Co., Ltd., which were approved at the annual meeting on February 7th, show that the receipts from weekly subscriptions increased by £121 to £837, in addition to donations amounting to £128. Grants totalling £798 were made to hospitals, convalescent homes, &c., and £163 was granted to members for various purposes. A balance of £95 is carried forward.

Electricians' Wage Claim.—According to the *Daily Herald*, the national claim for an increase in wages of 5 per cent. for electrical workers is to be discussed at a joint meeting between the National Federated Electrical Association and the Electrical Trades Union.

Copper and Lead Prices.—Messrs. F. Smith & Co. report, February 10th:—Copper (electrolytic) bars, £70 10s., 25s. inc.; ditto ditto, sheets, no change; ditto ditto wire rods, £77 10s., 35s. dec.; ditto ditto h.c. wire, 10 1/16, ¼d. inc. Messrs. James & Shakespeare report, February 10th:—Copper bars (best selected), sheet and rod, £96, £1 inc.; English pig lead, £38 15s., 10s. inc.

Engineering Employés' Wages.—A further meeting between representatives of the Engineering Employers' Federation and of the engineering trade unions was held in London on Tuesday last to negotiate further upon the men's application for increased wages.

After a long session no agreement was arrived at, the employers failing to make the offer which was anticipated. It is reported, however, that the proceedings were entirely amicable and that the conference was to be resumed on the following day.

Safeguarding of Industries.—The *Board of Trade Journal* of February 5th contained the Government's proposals for the protection of industries from unfair foreign competition. It is stated that the protective duties will only be imposed for a limited period to be laid down in a Finance Bill if the Board of Trade is satisfied after inquiry that the need for protection exists.

The industry must be one of substantial importance to the country either on account of the volume of employment which it affords or of the nature of the goods produced. The Board must be of opinion that the industry is subjected to exceptional foreign competition which prejudices employment in the industry. It must, moreover, be shown that the conditions in the competing countries are so different from those in this country as to render the competition unfair. The Board of Trade reserves the right to refuse an inquiry, irrespective of other conditions obtaining in the industry, if it is of opinion that the industry in question is not carried on with reasonable efficiency and economy, or that the imposition of a duty upon the class of goods produced will have an adverse effect upon employment in any other industry depending upon the use of such goods. If a *prima facie* case is established the Board will refer the claim for inquiry to a committee. This committee will report on the following:—(1) Whether the industry is of substantial importance; (2) whether foreign goods of the class produced are being imported for consumption into the United Kingdom in abnormal quantities; (3) Whether the selling price of these foreign goods is below the cost of production in the United Kingdom; (4) Whether the competition is severely affecting employment in this country; (5) Whether the conditions in the competing countries are such as to render the competition unfair: (*a*) by reason of depreciated currency, (*b*) on account of subsidies, bounties, or other artificial advantages, or (*c*) inferior conditions of employment of labour among the persons employed in the foreign industry; (6) Whether the applicant industry is being carried on with reasonable efficiency and economy; (7) Whether the imposition of a duty would have an adverse effect upon any other industry using the goods produced; and (8) Whether the claim for the imposition of a duty has been established, and if so, what rate or rates would be sufficient to countervail the unfair competition.

A committee will consist of not more than five persons appointed by the President of the Board of Trade. No person whose interests may be materially affected by any action which may be taken on the report of a committee will be eligible for appointment as a member of that committee.

Each committee will determine its own procedure. The evidence will be heard in public unless the committee is of opinion that certain matters are of a confidential character.

German Aluminium.—The conclusion of a commercial agreement between Germany and Switzerland is said not to have affected the German import veto on crude aluminium, which remains without change, although it is stated that permits will be unhesitatingly given in all cases in which foreign prices and conditions of sale are more favourable than those in Germany. It is proposed to introduce an anti-dumping clause in the future Customs laws, but the imposition of a duty on crude aluminium is not being striven for. On the other hand the rolling mills are said to have asked for an increase in the import duty on rolled products.

German Cable Industry.—It is reported in Germany that as a result of the exceptional activity of the British cable making industry, competition in world markets has recently slackened and that this circumstance has allowed German cable factories to obtain large orders both from North and South America for cables destined for the extension of the North American cable network. A German newspaper says, with what reason we do not know, that there is a prospect "that the Eastern and Eastern Extension Companies will allot comprehensive orders to the German cable industry in the near future," in connection with a large cable network extension which is to be undertaken in the next few months.

Electrical Organisations.—Lest any of our readers should have imagined from the advertisement appearing on p. xxxv of the ELECTRICAL REVIEW for February 6th, that the C.M.A., the B.E.A.M.A., E.L.M.A., A.M.A., &c., are all one Association, we are asked to state that "The Manufacturers' Association" (line eight of the thicker type) should of course read "The Manufacturers' *Associations*."

Lead.—Messrs. James Forster & Co., reporting on February 7th, stated:—"A rise of 47s. 6d. a ton in two days seems hardly justified by the position. Consumers have bought this week, but there is plenty of lead available to meet the demand. However, at the moment the market is in the hands of speculators, who may temporarily raise values higher still."

The Swiss Electrical Industry.—According to a review of the economic situation of Switzerland during 1924, the electrical industry is suffering from high railway rates, dear metal prices, and high wages. A slight reduction in the costs of production has been brought about through the introduction of the 52-hour working week. Competition from German firms is very marked.

New French Companies.—Among the new hydro-electric undertakings recently formed in France are La Société des Forces Motrice de la Haute Romanche, 25, Rue de la Pepinière, Paris (capital 5 million fr.), and the Société des Forces Motrices de l'Argoual, 25, Rue St. Honoré, Paris (capital 2,250,000 fr.).

Calendar.—What is probably the last of the 1925 calendars has arrived from the GENERAL ELECTRIC CO. (INDIA), LTD., Calcutta. This has large monthly sheets bearing illustrations of the apparatus with which the company deals.

The Leipzig Spring Fair.—We have received a map of Leipzig indicating the positions of the principal sections of the Fair which is being held from March 1st to 7th. A Technical and Building Fair is being held in conjunction with the main fair and it will be open until March 11th.

The Peruvian Electrical Market.—Keen competition on the part of German firms is anticipated in the electrical equipment field in Peru. Price will be the main factor. Italian firms have recently made large shipments of cable and wire being benefited by the Italian control of local electrical interests.—*Commerce Reports.*

The Prevention of Fraudulent Bankruptcy.—The Board of Trade Committee appointed to advise upon the amendments necessary to the existing bankruptcy laws has issued its report.

The Committee states that the evidence given before it led it to consider that in the main the Bankruptcy Act of 1914 was satisfactory but that more stringent measures were necessary to prevent fraudulent bankruptcy.

It is recommended that the period of six months before a bankruptcy during which certain acts are adjudged criminal offences, should be extended to twelve months. A collusive execution suffered or permitted by a bankrupt should render him liable to criminal proceedings. Section 158 of the Act should be amended so as to make the failure to keep proper books of account criminal under a first bankruptcy, subject to the following conditions:—(*a*) The present proviso to sub-section (1) of Section 158 of the 1914 Act, with the substitution of £500 for £100, should be retained, as a protection. (*b*) The law should further define the books to be kept so that they shall include accounts of all goods sold and bought, and sufficient details of such goods and of the buyers and sellers respectively to enable the goods and the buyers and sellers thereof to be identifiable. (*c*) No prosecution for this offence should take place before two years after the passing of the Act. The proviso to Section 161 should be repealed, and after the words in the section "if it appears to the Court that there is a reasonable probability that the debtor will be convicted," there should be inserted the words: "and that the circumstances are such as to render a prosecution desirable." Section 161 (giving the Bankruptcy Court power to commit for trial) should be repealed. The law should be altered so as to give courts of summary jurisdiction power to inflict up to 12 months' imprisonment for a bankruptcy offence, instead of only six months as at present. The maximum punishment under sub-sections (13), (14), and (15) of Section 154 should be five years' penal servitude as in the Larceny Act, 1916 (Section 32) which deals with obtaining property by false pretences. Moreover, the law should be altered so as to make it a criminal offence to receive property covered by these sub-sections of the 1914 Act. A provision regarding venue should be embodied in the law to enable an offender to be proceeded against in any country or place in which he is apprehended as if the offence had been committed there. The discharge of every bankrupt should be pronounced upon not later than two years after the close of the public examination and the Court should have power to require the bankrupt's attendance. The existing statutory minimum period of suspension of discharge should be abolished.

In Section 39, sub-section (1) there should be inserted the words "which is followed by an order of adjudication" after the words "receiving order."

The law should be altered to place on the same footing all the modes of administration of the estate of a bankrupt or insolvent who has previously been bankrupt, *i.e.*, Section 39 should be made to apply to a second or subsequent receiving order followed by the acceptance or approval of a composition or scheme and also where a prior bankruptcy is followed by an administration order under Section 130 (administration of a deceased insolvent's estate).

The Committee also suggests that the Bankruptcy Court might be given power to recommend the deportation of alien bankrupts in certain cases.

The Venezuelan Electrical Market.—The predominant position of the United States as a supplier of electrical apparatus and accessories to Venezuela is demonstrated by the figures for this section given in a recent supplement to *Commerce Reports*. The total value of electrical goods imported during 1922 (the latest year for which statistics are available) was 6,357,783 bolivars. Of this total, the United States' contribution was valued at 6,316,135 bolivars.

The International Glow Lamp Syndicate.—With further reference to the projected constitution of an international glow lamp syndicate, it is now reported that the syndicate has actually been formed and for a period of ten years. Besides American, French and German makers, the syndicate is asserted to include English firms, and it is to control both production and prices. It is said that the profits are to be pooled and distributed according to a pre-arranged key. Lamp producers in the smaller European countries are entitled to join the syndicate.

Italo-German Commercial Arrangement.—A provisional Commercial Arrangement has been made between Italy and Germany by which certain goods passing in both directions will receive most-favoured-nation treatment. The *Board of Trade Journal* says that among the German goods which are not accorded this concession by Italy are:—Electric generators weighing up to 250 kg.; electric transformers and accumulators; electricity and water meters; rotary pumps; and wrought iron and cast iron tubes and pipes.

The Business Efficiency Exhibition.—The fourth annual Business Efficiency Exhibition held in London since the war, organised by the Office Appliance Trades Association, was opened by Lord Burnham on February 4th; it remains open until February 14th. In declaring the exhibition open, Lord Burnham said that there was a danger that what was being gained in the machine shop and foundry would be lost in the office and behind the counter if up-to-date business methods were not adopted. There was, unfortunately, a tendency on the part of British business men to look askance at innovations; this attitude must be abandoned if their business was to prosper.

An outstanding feature of the exhibition itself is the growth in the number of electrically-operated machines on view. There are motor-driven calculators, addressers, tabulators, duplicators and copiers, and even an electrically-operated typewriter. The last has a small motor which is set in operation by the lightest touch upon a key—thus taking the strain off the typist's wrists.

A number of dictating machines are shown, all of them being based on the phonograph principle.

DICTOGRAPH TELEPHONES, LTD., shows a new development of its interdepartmental telephone system. This is a five-department arrangement which obviates the installation of more gear than is necessary in fairly small offices. The wall instruments are perfectly dustproof, a small shutter closing the only opening when the 'phone hook is in the down position.

The RELIANCE TELEPHONE CO., LTD., also exhibits an intercommunication system. This company's principal exhibit is a 25-line automatic telephone exchange for use as a private branch or for interdepartmental work. The operation is by the usual dialling system and selectors. Another system, employing the dialling arrangement on each separate instrument, is shown by the BRITISH HOME & OFFICE TELEPHONE CO., LTD. This arrangement is that devised by the International Electric Co., Ltd., whose works and products were described in our issue of November 28th, 1924 (p. 822).

The exhibition is an excellent display of devices for saving labour, time and money for offices of any size.

Swiss Electrical Enterprise in the United States.—It is reported from New York that a big scheme is being promoted in that country for the acquisition of from six to eight works for the production of electrical machinery and the work of railway electrification. Mr. Laurence Wilder, the New York representative of the American Brown-Boveri Company, is credited with the statement that negotiations for this purpose are proceeding, and the company hopes to begin activity within three months. The legal representative of the American company is Mr. Bainbridge Colby, formerly Secretary of State. It is stated that the reasons which have prompted the Boveri company to extend its activity to the United States are to be found in the incentive given by the directors of several American railway companies and various operating companies. The latter in particular are said to have wished the company to embark on business there in order to provide efficient competition with the practical monopoly hitherto possessed by the big American electrical firms. The several works to be taken over are situated on the East Coast between Boston and Chesapeake Bay, in the middle West, and on the Pacific Coast. The company hopes to play an important part in connection with the forthcoming electrification of the American railways, as well as in the establishment of hydro-electric works, possessing important patents that are unknown in the United States. According to a Swiss newspaper, the company is to have a share capital of $5,000,000. When asked for information on the question by a Swiss newspaper, Messrs. Brown, Boveri & Co. are reported to have replied that the scheme in the main corresponds with the above facts, but not in the details. So far, however, the project does not imply any obligations on the part of the Swiss company. The expenditure on the works in the United States, as reported from New York to Oslo, Norway, is to be $40,000,000.

Brazil a Good Market for Electrical Goods.—Our Special Correspondent writes as follows:—"While South American markets in general show a decrease in purchases of electrical equipment of foreign manufacture, Brazil is an exception. During the past year this State was the largest purchaser, making a well-sustained demand for electrical goods in general, but importing also an increased number of electric locomotives. Electric lighting plant is about to be installed under the superintendence of El Senhor Prefeito, Acarahu, Ceará, from whom full particulars of the proposed installation can be obtained. It is also intended to reorganise and consolidate the four companies now supplying electric energy in the port of Maceio, capital of the State of Alagoas. Imports of electrical goods into Brazil have, so far as the present year has gone, continued to increase, the major portion of the business being secured by American firms, with the second place occupied by Germany. The principal imports of electrical apparatus from the United Kingdom appear to be in the direction of telephone and telegraph equipment and of insulated wire and cable, while batteries and accumulators show a high percentage in comparison with these manufactures derived from other sources. A considerable proportion of the material being used by the Bureau of Telegraphs comes from the United Kingdom, while if the whole history of telegraph installation in Brazil were examined, it would be found that British manufacturers have played a highly important part in their construction and equipment. The telegraph service covers the whole country, while the telephone system serves only the States of Rio de Janeiro and Espirito Santo."

Less Dishonest Trading.—The annual report for 1924 of the Official Receiver for the Manchester district states that there is less dishonest trading. He says that "it would be too much to hope that dishonest traders have been entirely rooted out, but for the moment, at any rate, there is less evidence of their existence in the Manchester district than at any time since the collapse of prices in the spring of 1919 proved too great a strain on the commercial integrity of a certain section of the business community."

New Spanish Company.—An influential committee has been formed in Barcelona to float a new company styled the Impulsora de Nagocios Electricos in order to take over the Sociedad Productora de Fuerzas Motrices, whose financial position has not been over-satisfactory recently. The new company assumes all the assets of the old company, including the falls of the Valle de Aran and other concessions, and contemplates raising a capital of 40,000,000 pesetas.

New Algerian Company.—A new company has lately been formed at Tebessa, Algeria, with a capital of 550,000 fr., and the title La Société Omnium Algerien d'Electricité, to establish hydro-electric stations in Algeria and Morocco.

Blackpool Exhibition Proposal Deferred.—A scheme to have a six weeks' electrical exhibition was referred back to Blackpool Town Council on February 4th. The electrical engineer had recommended the holding of the exhibition during November and December next, and the Blackpool Winter Gardens Co. offered the use of its premises in Church Street for the purpose. Councillor Tatham said it was incorrect to state that local private electrical apparatus dealers had withdrawn their objection to a municipal scheme, as provided for in the rejected clause of Blackpool's recent Parliamentary Bill. He said it was time that municipal tampering with competitive trading ceased.

Unemployment.—A further decrease occurred in the number of registered unemployed during the week ended January 26th. The total at this date was 1,241,000, as compared with 1,269,733 a week earlier.

Lighting and Power Notes.

Aberdeen.—ELECTRICITY EXTENSIONS.—The Town Council has approved a report submitted by the electrical engineer, Mr. J. Alex. Bell, recommending extensions to the power station at an estimated cost of £198,199. These extensions form an instalment of a scheme of expansion of the city's electricity undertaking agreed upon by the Council some few years ago. The whole scheme when completed will cost £400,000. The electrical engineer in his report estimates the cost of the work on the instalment just sanctioned as follows:—

Buildings: Extension of boiler-house, £30,000; four 50,000 lb. boilers, including superheaters, economisers, stokers, &c., £69,500; steam, feed, blow-down and drain piping and valves, £1,705; coal conveying plant, £3,937; ash removing plant, £6,270; electrically-driven boiler feed pump, £1,041; circulating water pipes and valves, £2,157; one 10,000 kW turbo-alternator with accessories, £49,896; l.p. wiring in power house, £1,289; l.p. switchgear and cables in power house, £5,911; e.h.p. switchgear and cables, £2,688.

Sub-station plant: Two 1,500 kW motor converters and starting gear, £6,257; e.h.p. switchboard, £5,005; 440-V. d.c. switchboard, £4,884; switchboard galleries, &c., £1,543; cabling and wiring for sub-station, £3,190; two 20-ton hand-operated travelling cranes and gaptries, £1,980; concrete foundations, cable ducts, £946. Application is to be made for sanction to the carrying out of the work and to the borrowing of £198,199 to meet the expenditure.

Bexhill.—ELECTRICITY IN BULK.—The Town Clerk has reported to the Council that further particulars have been received from the Hastings Corporation regarding the proposed bulk supply, and he suggests consulting the Council's expert advisers, and taking counsel's opinion if necessary.

Bradford.—AUTOMATIC PLANT.—The Electricity Committee has recommended to the Corporation that two machines at Thornbury and Odsal sub-stations be converted to automatic operation. The estimated cost of the scheme is £6,000.

Cardiff.—ELECTRICITY SCHEME.—The Finance Committee has agreed to a proposal of the Electricity Committee for the changing over of the electricity supply for Mynachdy and Gabalfa from the South Wales Power Distribution Co.'s supply to the Roath power station supply at a cost of £8,000.

Cheadle and Gatley.—LOANS.—The Urban District Council has received sanction to loans of £6,000 on account of expenditure incurred for mains and services and £2,250 for services, and has applied for sanction to a further loan of £3,500 for extensions for the next two years.

Chester.—NEW PLANT.—The City Council has decided to purchase three Green economisers at a cost of £2,226 to replace economisers that will shortly require renewing.

Chesterfield.—ELECTRICITY IN BULK.—The Electricity Committee has recommended the Town Council to accept an additional supply of electricity in bulk from the Staveley Coal and Iron Co., at .75d. per kWh during the hours of 3.30 p.m. to 6.30 p.m. in November, December and January next.

Coventry.—ELECTRICITY IN BULK.—The City Council has approved a recommendation of the Electricity Committee that arrangements be made with the Leicestershire and Warwickshire Electric Power Co., for a bulk supply of electricity to the Corporation. It was stated that the Electricity Commissioners were unwilling at present to sanction the erection of a new generating station. It is proposed that the agreement with the company should cover a period of five years and that £16,750, the estimated cost of laying the cable, should be paid out of revenue.

Glasgow.—WIRING OF SMALL HOUSES.—The Corporation electrical engineer reports that 270 tenements have been wired on the hire-purchase system, and the sub-committee on propaganda has recommended that he be authorised to wire an additional 200 tenements and some small villas.

Grimsby.—ELECTRICITY EXTENSIONS.—A scheme to extend the Corporation electricity supply by laying a further 9½ miles of cables at a cost of £12,000, has been sanctioned by the Unemployment Grants Committee, and the work will be commenced within a few weeks. The Unemployment Grants Committee has guaranteed half the interest for a period of 15 years. The Electricity Committee has overspent the sum of £19,000 borrowed in November, 1922, for the provision of l.p. and h.p. mains and services. According to the report of the Chief Engineer (Lieut.-Col. W. A. Vignoles, D.S.O.), to the Electricity Committee last week, £13,635 had been expended in March last on feeders and mains and £8,127 on services. To cover the amount overspent and to provide for mains and services laid during the current year and to be installed up to March, 1927, he recommends that application be made for sanction to borrow £15,000.

Haworth.—ELECTRICITY SCHEME.—At the Urban District Council meeting on February 3rd, a report by the Council's engineer on plans for the installation of an electricity supply for the township were approved and it was decided to apply for sanction to borrow £7,500 for the purpose. It is proposed to secure a bulk supply, to be distributed by the Council.

Ilkley.—STREET LIGHTING.—The Urban District Council, on February 4th, decided to apply for sanction to a loan for converting from gas to electricity 314 street lamps, subject to assistance being given by the Unemployment Grants Committee. Application is also to be made for powers to supply electricity to Denton Hall and the farms and cottages on the Hall estate.

Inverness.—ELECTRICITY SCHEME.—The Town Council is to proceed with a scheme for utilising the water power at Bught Mill for generating electricity. The cost is estimated at £7,400. The Town Chamberlain reports that a loan of £80,000 has been arranged to meet the cost of the purchase of the local electricity works.

London.—HACKNEY.—The Borough Council has decided to borrow from the Public Works Loan Commissioners, the sum of £35,375, of which £28,000 is to be spent on mains for street lighting.

BATTERSEA.—The accounts of the borough electricity undertaking (engineer, Mr. F. A. Bond) for the year ended March 31st last record a total revenue of £125,865, as compared with £126,701 in the preceding year. Working expenses amounted to £72,814, as against £59,467, leaving a gross surplus of £53,051 (£67,234). After payment of capital charges there was a net profit of £15,547, as compared with £30,343 in 1922-23, to which was added a balance brought forward of £53,979, making a total of £69,526. This was distributed as follows:—Special loan repayment, £7,524; reserve fund, £10,000; sundry capital items, £3,393; balance carried forward, £48,609. During the year £31,649 was spent on capital account, the chief items being £13,301 for machinery, &c., and £13,054 for mains and services. The sales of electrical energy amounted to 17,511,157 kWh, an increase of 2,879,351 kWh, and the average price per kWh obtained fell from 2.06d. to 1.725d. The maximum supply demanded rose from 7,700 to 7,800 kW.

FULHAM.—The Borough Council has received sanction to a loan of £2,849 for the erection of two new coal bunkers.

Maidstone.—DOMESTIC APPLIANCES.—The Town Council has received sanction to a loan of £1,000 for the purchase of domestic electrical apparatus to be let out on hire.

Manchester.—NEW PLANT.—The Corporation electrical engineer has submitted a report on proposed extensions at several sub-stations to meet the increased demand. The installation of the following new plant is recommended:—Manually-operated plant—Longsight, Hulme, and Newton Heath: One 1,000-kW set at each station. Fallowfield and Withington: One 750-kW set at each station. Chorlton: Two 750-kW sets. Harpurhey: Two 750-kW sets. Cheetham Hill: Two 750-kW sets. Automatically or semi-automatically controlled plant.—Gorton, West Didsbury, Didsbury, and Whalley Range: One 750-kW set at each sub-station. The estimated cost of the whole of the new plant required is £55,000.

DECEMBER LOAD RECORD.—The highest maximum demand ever experienced by the electricity undertaking occurred on December 9th last, the figure being 120,740 kW; the previous record was 108,920 kW. During the month of December the connected load increased by 1,380 kW to the total of 243,545 kW, and the number of cookers on hire rose from 533 to 575.

Mold.—ELECTRICITY SCHEME.—The Urban District Council has had under consideration a scheme for the establishment of its own electricity works as an alternative to obtaining a bulk supply from outside sources. It was urged at a recent meeting that before the scheme, which is estimated to cost £6,600, is proceeded with, another canvass of the town should be taken in order that it might be determined if there were sufficient consumers to make the undertaking profitable. Finally, however, the Council decided in favour of the scheme and the work is to be proceeded with, subject to the consent of the Electricity Commissioners, at an early date.

Morocco.—WATER POWER DEVELOPMENT.—Under the law passed in 1920, the Government of the Protectorate of Morocco was authorised to contract a loan of 744,000,000 fr., of which a credit of 39,000,000 fr. was to be opened for the utilisation of the water power of the country. A first works of 18,000 kW has been constructed, and transmission lines 60,000-V are in course of erection, but only a sum of 5,000,000 fr. has been taken out of the credit of 39,000,000 fr., although a decree was issued last month authorising the grant of the balance of 34,000,000 fr. It is now proposed to invite tenders for the construction of a hydro-electric works of 12,000 kW on the Oumer-Rebia and to undertake other works in connection with the utilisation of the water power of the country.

Northern Ireland.—PORTADOWN (CO. ARMAGH).—The local electric light company has come to a satisfactory agreement with the Urban District Council and the latter has withdrawn its opposition to the electricity scheme.

BELFAST.—The Corporation is applying to the Electricity Commissioners for Northern Ireland for sanction to a loan of £8,403 for the extension of the electricity supply to Ligoniel district.

Nuneaton.—ELECTRICITY IN BULK.—The Electricity Committee has appointed Mr. E. M. Lacey, of Westminster, to advise on the question of a bulk supply, and has reported to the Town Council that a further offer has been received from the Leicestershire and Warwickshire Electric Power Co. It is recommended that application be made for sanction to a loan of £10,000 in connection with the Hartshill and Weddington scheme.

Oldham.—LOAN SANCTIONED.—The Corporation has received sanction to a loan of £60,000 for mains and transformers.

Peterborough.—LOAN.—The Town Council has applied for sanction to loans of £5,747 for b.p. mains, and £1,730 for street lighting.

Pontypool.—ELECTRICITY SUPPLY.—The Town Council has received a communication from the Pontypool Electric Light and Power Co. submitting proposals with regard to the electricity supply in the area. The company proposes, under certain conditions, to lay new cables with an overhead service, and to obtain a bulk supply from the South Wales Power Distribution Co., and it will supply electricity to the Council at 7d. per kWh and to private consumers at 8d. kWh, less 10 per cent., for prompt payment of accounts instead of the present charge of 11d. per kWh, less 10 per cent.

Sheffield.—EXPLOSIONS.—A series of subterranean explosions occurred at Sheffield on February 8th, blowing off the covers of a number of manholes. The explosions, which occurred within a radius of 150 yards, are attributed to a defect in the underground cables, coupled with accumulation of gas in the manholes.

ELECTRICITY EXTENSIONS.—The Electric Supply Committee has approved extensions of distribution mains at a cost of £12,156, and electricity extensions and works at an estimated outlay of £7,598.

South Africa.—JOHANNESBURG.—The Tramways and Lighting Committee of the Corporation has decided to proceed with the plan for a new power station. A start with the scheme will be made with the new 10,000 kW generating set which is at present on order, and tenders for the completion of the station are to be called for. In an effort to counter the veto by the Provincial Executive, a deputation from the committee, accompanied by the chairman of the Finance Committee, is to seek an interview in Pretoria with General Hertzog, Mr. Tielman Ross, Mr. Beyers and Col. Creswell. The Government will be asked to introduce a Bill amending the Electricity Supply Act, so as to exclude Johannesburg from the provision limiting electrical undertakings to a 10 per cent. annual development, and to remove the veto, exercised by the Provincial Executive in the present instance, on calling for tenders for a new station.

Stalybridge.—POWER STATION EXPLOSION.—An explosion occurred at the power station of the Stalybridge, Hyde, Mossley, and Dukinfield Board on February 5th, which cut off the electricity supply in the four towns. The accident was due to the short circuiting of a cable which caused an explosion in the main switchgear. The power station caught fire, but the flames were quickly subdued and the greater portion of the machinery was saved. An emergency supply of electricity was obtained from Ashton-under-Lyne, Stockport, and Manchester, and the tramway service between Hyde and Manchester was resumed. A number of cotton and woollen mills had to cease operations.

In connection with this mishap Messrs. Ferguson, Pailin, Ltd., write to say that the fire occurred on an old German switchboard and not on one of the boards supplied to the station by them.

Stoke-on-Trent.—LOANS.—The Corporation has received sanction to borrow £5,500 in connection with the change-over of the system of supply in Wolstanton, and £3,000 in connection with the provision of Merz-Price protection on the Burslem and Longport feeder. The following extensions are recommended by the Electricity Committee:—New feeder from Stoke sub-station to London Road, £2,500; l.p. cable and switchgear for the Hanley supply, £6,000; extension of supply, High Lane district, Burslem, £1,050; distributing main from Burslem works to housing scheme site, Scotia Road, Burslem, £1,150; new feeder, Stafford Street, Longton, £1,100.

Stretford.—LOANS SANCTIONED.—The Urban District Council has received sanction to loans of £10,000 for e.h.p. mains and £10,000 for l.p. mains and services.

Wick.—ELECTRICITY SCHEME.—The Town Council is to proceed with a scheme for the electric lighting of the town at a cost of £10,831. An Order is being applied for.

Yarmouth.—ELECTRICITY SUPPLY.—The first 3-phase supply for the town was switched on by the Mayor at the Corporation electricity works on February 2nd. This is for supplying the South Denes district, and forms part of a big scheme which it is estimated will ultimately cost £194,000.

Tramway and Railway Notes.

Bradford.—TRACK RENEWALS.—The Estimates Sub-Committee of the Corporation has approved the Tramways Committee's proposal to re-lay the track from Four Lane Ends to Allerton and from the city to Dirkhill Road (Great Horton section).

RAILLESS CARS.—The Committee has deferred consideration of the proposed substitution of a railless-car service on the Idle and Thackley sections in place of railed cars, for study of the reports of the City Treasurer and Tramways Manager on the subject.

Continental.—ITALY.—It is reported that work has commenced on the construction of an electric railway to link up the towns of Turin, Milan and Genoa. The towns form a triangle, each side of which is between 70 and 80 miles in length, and it is hoped to do each stretch of the journey in about an hour. The construction of the line from Turin to Milan is being undertaken first.

The Nord-Milan Railway Co., which operates about 175 miles of railway between Milan and the Lombardy lake district has submitted a scheme to the Italian Government for the electrification of a part of its system at an estimated cost of 60 million lire.

Darwen.—TRAMWAY EXTENSION.—The Tramways Committee proposes to extend the Bolton Road service from the terminus at Whitehall to the Cemetery.

Halifax.—TRAMCARS *v.* 'BUSES.—At the Town Council meeting, on February 4th, there was further discussion on tramcars *versus* motor 'buses. It was recommended that the Tramways Committee's minutes containing a proposal for the renewal of track at Luddendenfoot, on the Hebden Bridge route, be referred back and that six or eight 'buses per section be tried for a period and the total cost of the services compared month by month with tramway costs. A gradual change-over from tramcars to motor 'buses as cars and track wore out was urged. The minutes were, however, adopted.

India.—RAILWAY ELECTRIFICATION.—Sir Leslie Wilson, the Governor of Bombay, on February 3rd opened the first electric railway in India, when he set in motion the first train on the Harbour Branch of the Great Indian Peninsula Railway, which feeds the Bombay docks and that portion of the suburbs of Bombay towards Kurla, a distance of ten miles. The section which has been electrified constitutes the first step in a general scheme of electrification of the suburban lines as far as Kalyan, thirty miles from Bombay, the whole of which is expected to be completed by the beginning of 1927, and is designed to meet the increasing volume of suburban traffic.—*Reuter* (Bombay).

Liverpool.—FARES.—The Tramways Committee has recommended the City Council to increase by one penny (to 3d.) tramway journeys that exceed 4½ miles. The increase is expected to yield an additional revenue of £14,250.

London.—MORDEN TUBE.—Contracts totalling £107,000 have now been placed with Messrs. Waygood Otis, Ltd., for the construction of escalators at stations on the Morden tube extension. With the exception of North Morden, where the station will be in the open, two escalators will be installed at each station on this new railway, *viz.*:—Nightingale Lane, Balham, Trinity Road, Tooting Broadway, Collier's Wood, and South Wimbledon. All these new moving stairways will be of the "Cleat Comb" type.

PICCADILLY TUBE STATION. — It is reported that work on the rebuilding of the Piccadilly Circus tube station will commence immediately. The new station will be capable of dealing with 50,000,000 passengers annually. Nine escalators are to be installed, a record for one underground station, and there will be seven connections by subways to various parts of Piccadilly Circus.

LONDON BRIDGE STATION.—The Underground "exchange" station at London Bridge was re-opened for traffic on February 9th.

Manchester.—TRAMWAY DEVELOPMENT.—According to the Manchester *Daily Dispatch*, developments in connection with the Corporation tramway undertaking, which will entail an estimated expenditure of £550,000, are to be carried out. The principal items are:—60 new tramcars, £150,000. New track: Princess Road, Lloyd Street and Platt Lane, £110,000; Cambridge Street, Birchfield Road, and Newton Street, £65,000; Victoria Avenue, £58,000; Moseley Road, £22,000; Wilbraham Road, £8,000 and £24,000; various junctions, £8,000. Motor 'bus garage, Parr's Wood, £50,000. Hyde Road depôt: Boiler-house and other works, £29,400; electrical equipment £10,000.

South Africa.—NATAL RAILWAY ELECTRIFICATION.—On January 12th, the current was switched on to the overhead equipment of the electrification system of the Natal main line between Estcourt and south of Mooi river. It is some months since the first stretch of line was completed, and trains have been running under the new power for some time between Daimen and Chieveley, while frequently, for testing purposes, these trains have been continued under electric power so far as Estcourt. It is not yet known when tests will be carried out on the new section, but it is now completed, making a length a little over 70 miles, in all.

South Shields.—UNDERGROUND RAILWAY.—The Town Council has been informed by Messrs. Baker and Co., Parliamentary agents, that the promoters are not proceeding during the present session of Parliament with the Bill for the proposed construction of an electric railway under the river between North Shields and the southern borough.

Tramway Fares.—The following is a further list of undertakings which have received sanction to maintain increased fares under the Tramway (Temporary Increase of Charges) Act, until December 31st, 1925:—Colne Corporation; Bexley Tramway and Dartford Light Railway; Barking Town Urban District Council Light Railways; Haslingden Corporation; Cheltenham and District Light Railway; Dundee Corporation; Dundee, Broughty Ferry and District Tramways; Worcester Tramways; Luton Corporation; Norwich Electric Tramways; Colwyn Bay Electric Railway; Swansea Tramways; London United Tramways; Mexborough and Swinton Tramways; Pontypridd Urban District Council; Preston Corporation; South Lancashire Tramways; Kilmarnock Corporation; Kirkcaldy Corporation; Llanelly and District Light Railways; and York Corporation.

The Hartlepools.—PARLIAMENTARY BILLS.—The Hartlepool Town Council and the West Hartlepool Town Council have taken steps to deposit Bills in Parliament seeking powers for rival 'bus services between the two boroughs. Representatives of the two bodies met on January 30th and a scheme was put forward for the consideration of the respective Councils under which a joint railless-car service would be jointly operated, Hartlepool to pay the cost of purchasing the existing tram track within its own area, its share of the tram-sheds, of the cost of the railless-cars, and the provision for new overhead equipment. In the event of the scheme being adopted, Hartlepool will withdraw its opposition to West Hartlepool's Bill and will also withdraw its own Bill applying for powers to run motor 'buses between the two towns. West Hartlepool will also withdrew the provision in its Bill to run railless vehicles in Hartlepool.

Telegraph and Telephone Notes.

Australia.—PRESS CABLE RATES.—It is reported that the reduction of Press cable rates is under discussion by the Commonwealth Government and the Pacific Cable Board.

Imperial Radio Communication.—ANOTHER POLICY?—Twelve months ago the Donald Committee reported in favour of a scheme of development by private enterprise with Government control. The report was accepted by the Labour Government, and the Committee was asked to prepare details of the proposed control. This proved a difficult task, for, in addition to the Post Office, the Naval and Military Departments required representation on the controlling body. The Committee was understood to be on the point of reporting when the Labour Government fell. The new Postmaster-General did not reappoint the Committee, and the omission

has been taken to indicate that its report would not have been unanimous, says the *Birmingham Post*, which points out that Sir William Mitchell-Thomson has just appointed a new assistant secretary in his Department, who has had long experience of Imperial wireless. A policy has been discussed, and plans based on that policy will be available shortly.

India.—LONG-DISTANCE TELEPHONY.—Our Bombay correspondent informs us that the trunk line between Delhi and Bombay was to be opened to traffic last month, giving Northern India the most extensive telephone service in the country. The trunk lines between Simla and Delhi, Delhi and Lucknow, Lucknow and Allahabad, are in use and the Punjab has a very efficient system in operation. It is understood that efforts are also being made to extend the trunk line between Allahabad and Calcutta through Patna. Some improvements are being made in the trunk system service between Calcutta and the coal fields.

AUTOMATIC WORKING.—Asansol is to be equipped with a new automatic station. The automatic system is becoming popular in India and wherever it has been introduced has worked most successfully. In Simla it has been in operation for over 12 years, while Bombay and Madras have introduced it recently with great advantage. Poona, Ootacamund, Nagpur, Lahore, Rawalpindi, and the coal fields have also installed the automatic system. The charges are important, on the proper handling of which a large part of the success of the trunk lines will depend. Government telephones barely pay for their upkeep at present, and a flat rate for long-distance calls would prove financially a failure. It is suggested that the Government should frame its charges on a well-defined principle, basing them proportionately in relation to distance, and making charges for long-distance telephone traffic as low as possible. This would induce greater traffic and therefore a better financial return.

"BEAM" RADIO STATION.—It is understood that the Government of India has offered to grant a licence to the Indian Radio Telegraph Co. to operate a "beam" radio station in India for communication with the United Kingdom, subject to an agreement the terms of which will shortly be signed.—*Reuter* (Delhi).

Telegraph and Telephone Services.—FINANCE.—Details of the work of the Post Office are contained in a White Paper dealing with the commercial accounts of that Government Department for the year ended March 31st last. After charging interest on capital, there was a surplus of £1,596,917 on the telephone service, but a deficit of £1,270,925 on the telegraphs. The message fees collected in connection with the telegraphs amounted to £5,113,010. With receipts from cable companies totalling more than the payments, there was a net income of £5,135,145. Rentals and call fees for telephone service realised £14,428,394, in addition to which the services rendered to the telegraph service were valued at £102,786. Advertisements, royalties, and the sale of directories produced £114,412. The Imperial cable service showed a loss. The receipts for message fees, &c., were £226,005, while the expenditure, including interest on capital, was £37,772 above that amount.

Radio Notes.

Broadcast Entertainers.—FEWER AUDITIONS.—Over 20,000 would-be broadcast artists have been given auditions by the B.B.C. Six large volumes contain the particulars of the tests, and a studio had to be set apart on three or four days a week. Now there is to be a slackening down, says the *Evening News*, not because the B.B.C. authorities do not want more artists, but because the auditions have grown out of proportion to the results they give, and the time which can be devoted to them. Less than one in every hundred trial turns were found suitable; however, the B.B.C. has a card index of about 1,000 artists of all kinds. A good "wireless" artist differs considerably from his equally successful colleague on the concert platform. Versatility is the lifeblood of broadcasting.

Broadcasting.—EMERGENCY USE.—An example of the manner in which broadcasting may be utilised when public men find themselves unable to keep their appointments was afforded at Birmingham on February 4th. The Lifeboat Fayre organised by the Royal National Lifeboat Institution was to have been opened on the second day by Admiral Sir Doveton Sturdee, but the Admiral was unavoidably prevented from attending. Arrangements were quickly made, however, for Viscount Curzon to open the Fayre from 2LO, the London station. Speaking in the studio, Lord Curzon's speech was relayed to the Birmingham station, 5IT, and passed thence by landline to the Town Hall, where loud speakers which had been hastily installed enabled the audience to hear the opening address quite clearly. The speech was also broadcast in the usual way from 5IT, as were also the speeches of Prince Henry and Princess Bibesco on the other days of the Fayre.

Broadcasting Plays.—COMMITTEE MEETING.—Representatives of the entertainment industry and the British Broadcasting Co. met again on February 4th, when agreement was reached on several important points. The conference was adjourned for the entertainment representatives to consider some new proposals made by the B.B.C.

Licences.—RECEIPTS.—According to the Post Office commercial accounts, receipts from licences issued to the public amounted, in the twelve months ended March 31st last, to £250,055, of which £189,183 was paid over to the British Broadcasting Co. From the balance of £60,872 had to be deducted the cost of administration and issue of licences (£37,023), printing (£2,179), engineering expenditure (£2,700), and estimated pension liability (£4,373), leaving a net surplus for the year of £20,729. However, it is stated that "the actual receipts from licences issued to the public amounted to £54,513 during the period to March 31st, 1923, and £497,822 during the year 1923-24."

United States.—DESIGNATION OF STATIONS.—A movement has lately been inaugurated in the United States with the object of having broadcasting stations designated by their frequency, in kilocycles, instead of by wave length.

RADIO CORPORATION INCOME.—Reflecting the tremendous growth of the radio industry in 1924, the Radio Corporation of America, in its annual statement of earnings which has been issued to stockholders, reveals that the gross income from operations last year reached the new high record total of $54,848,131 (£11,000,000). The company reported gross sales of only $1,468,920 in 1921, a year when few were able to visualise the potentialities of radio-telephone entertainment.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Ashford (Kent).—February 23rd. Electricity Department. Three 400-kW, 3-phase alternators, and 15 e.h.p., 6,600-V switchgear cubicles. (February 6th.)

Australia.—SYDNEY.—March 30th. Municipal Council. Maximum demand indicators.*

MELBOURNE.—March 4th. Victorian Government Railways. Telephone equipment.*

April 1st. Electrical equipment for motor coaches and trailers.*

Postmaster-General's Department. March 10th. Primary battery parts.*

April 7th. Commonwealth P.M.G.'s Department. Wall and table telephone sets. (See this issue.)

Bargoed (Glam.).—February 16th. Gellygaer Urban District Council Electricity Department. Six months' supply of cable, house service prepayment meters, cut-outs, overhead line material, poles, &c. (February 6th.)

Belfast.—February 28th. Electricity Committee. Stores for 12 months, including electrical accessories, lamps, carbon brushes, meters, cables, &c., &c. (February 6th.)

Belgium.—February 18th. Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. 48 lots of miscellaneous telephone material. Particulars (Cahier des Charges Special No. 3-84) for 5½ fr.

February 25th. Municipal authorities of Saint Gilles, Brussels. 1,500 amp.-hour meters and 29 watt-hour meters, all for 220 V, d.c. Particulars (3 fr.) from Service d'Electricité, 40, Rue de Bethléem, St. Gilles, Brussels.

March 25th. Société Nationale des Chemins de Fer Vicinaux, 14, Rue de la Science, Brussels. Underground electric cables for the extension of the feeder system on the Brussels-Dilbeck local railway. Particulars (3 fr.) from Bureaux des Services Electriques, 48, Rue de Montover, Brussels.

Birmingham.—February 28th. Tramways Committee. Traction motors, power wiring, &c., for 30 tramcars. Particulars from Mr. A. C. Baker, chief engineer, Corporation Tramways, Birmingham.

Bradford.—February 14th. Corporation. Electric lighting installations for three housing schemes (258 houses). City Architect, Town Hall.

Bri Chualann.—February 17th. Urban District Council. Centrifugal oil separator, with motor starter, &c. (See this issue.)

Bridlington.—February 16th. Electricity Works. One 600-kW steam turbine, reduction gear, and d.c. generator. (January 30th.)

Cardiff.—February 20th. Electricity Department. 12 months' supply of paper-insulated cables. (February 6th.)

Cockermouth.—Cottage Hospital Committee. Electric lighting installation at the hospital. (See this issue.)

(Continued on page 263.)

Electricity Supply at Grimsby.

Recent Generating Plant Extensions.

THE inauguration of the Grimsby Corporation electricity undertaking took place 25 years ago, d.c. reciprocating steam plant being added from time to time until the first steam turbo-generator was installed in 1913. It was a mixed-pressure machine driving two 500-kW d.c. generators, the source of l.p. steam being the exhaust of the reciprocating sets, and raised the station capacity to some 2,500 kW.

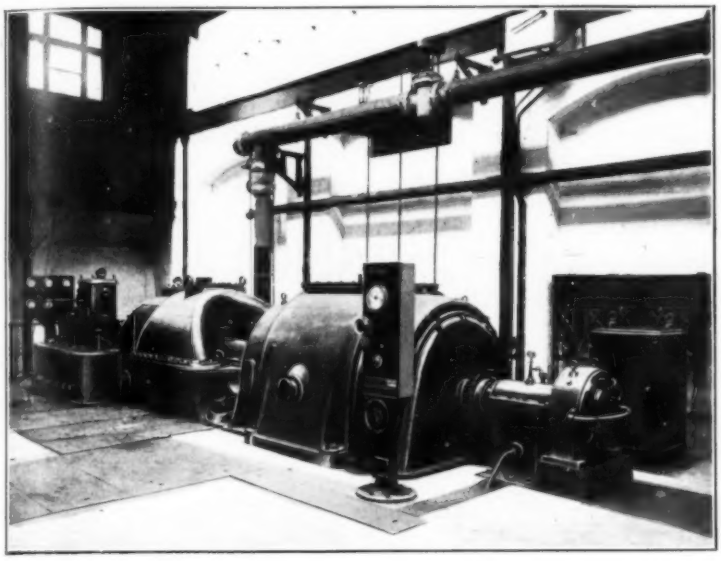


Fig. 1.—New Metropolitan-Vickers 3,000-kW Turbo-Generator at Grimsby.

The outbreak of war caused the 1914 scheme of extension to be postponed; in 1919 plans were prepared for the introduction of a.c. plant, and a 2,500-kW turbo-alternator started operation in 1921. It was soon loaded up, however, but in view of the then high cost of plant it was decided to defer the next extension pending a fall of prices; it was, therefore, not until October, 1924, that the 3,000-kW machine, fig. 1, was completed. It is provided with a closed air circuit and an air cooler. Both machines are of the 6,600-volt, 3-phase, 50-cycle, 3,000-r.p.m. type and, with their condensers, were supplied by the Metropolitan-Vickers Electrical Co., Ltd. Cooling towers are used, and two 18-in. artesian wells assist in providing cold water at periods of heavy load.

About the same time as the 2,500-kW turbo-generator, a Metropolitan-Vickers rotary converter was installed, with the necessary transformer and switchgear, having an output of 960/1,080 kW at 480/540 volts d.c.; it is a 6-phase, shunt-wound, 750-r.p.m. machine with a starting motor. A similar machine, but compound wound and running at 500 r.p.m., was supplied by the same firm a little later, and a few months later still, a smaller rotary converter with an output of 250 kW was supplied, it having no starting motor, but being "tap started" from the a.c. system.

Two further rotary converters of the same make were installed last year, one being a 250-kW machine and the other having an output of 1,000 kW at 750 r.p.m.

The earlier steam generating plant consisted of four Lancashire and two Stirling water-tube boilers (installed in 1912), all being fitted with automatic Underfeed stokers, and two other Stirling boilers, fig. 2, were installed in 1920. Each of the water-tube boilers has a heating surface of 5,805 sq. ft., and is capable of evaporating 21,000 lb. of water per hour actual on normal load, or 28,500 lb. per hour on overload; the working pressure is 200 lb. per sq. in.

Each boiler is fitted with a Stirling integral superheater capable of imparting a superheat of 250 deg. F. to the full output of steam, and is fired by two mechanical class "A" self-contained Underfeed stokers, 14 ft. 4 in. long by 5 ft. wide, giving a combined grate area of 143 sq. ft. per boiler. Forced-draught fans supply air for the complete combustion of approximately 1,900-2,700 lb. coal per hour. Flat suspended Dettrick arches are fitted in the furnaces of two of the boilers, and each Sirocco induced-draught fan is capable of dealing with from 40,000-42,000 cu. ft. of flue gas, while the four Green economisers each contain 200 tubes 11 ft. 6 in. long, increasing the temperature of the feed water from 110 to 225 deg. F.

Each pair of boilers discharges into a steel-plate guyed chimney 6 ft. in diameter and 40 ft. high, and it is interesting to note that they are fitted with grit arresters made by Messrs. Davidson & Co., Ltd., which apparatus has proved most effective in use. Lea coal meters are installed and Diamond soot blowers. The overall efficiency of the boiler plant is said to be 82 per cent. An Usco water-trough conveyor removes the ashes and clinkers.

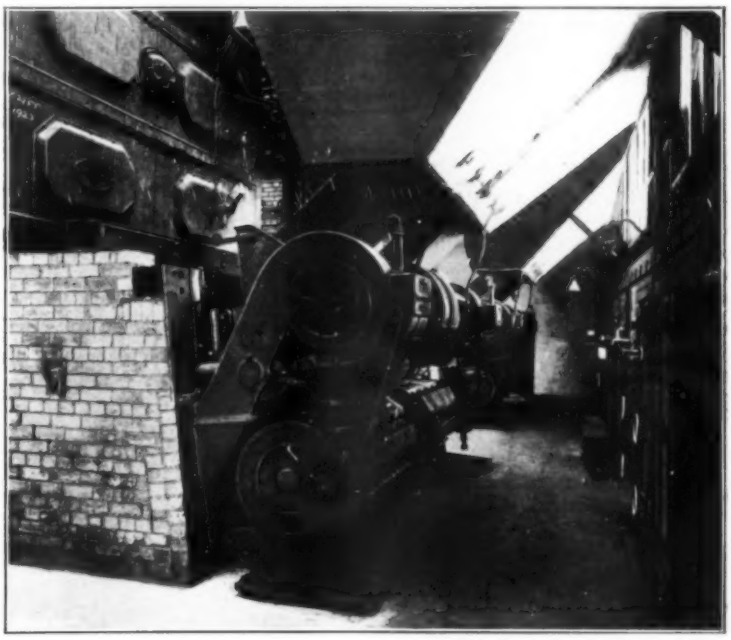


Fig. 2.—New Stirling Boilers with Underfeed Stokers.

The recently-added switchgear follows the lines of the apparatus installed in 1919 by the New Switchgear Co.

It was made by the Metropolitan-Vickers Electrical Co., Ltd., and includes a five-cubicle extension and a corresponding addition to the main board for controlling the new 3,000-kW alternator, a 175-kVA transformer, the auxiliary circuits, and two outgoing feeders. The cubicles are built up of moulded stone supported in a steel framework. In the basement a smaller structure contains the isolating switches on the outgoing feeders and surge arresters; phase separation is maintained throughout the whole structure. The alternator circuit is provided with Merz-Price protection (circulating current) and the feeders also, but operating on balanced voltage.

In the sub-stations Metropolitan-Vickers truck-type switchboards are used. As the d.c. network is solidly interconnected, loading resistances with automatic contactors have been installed in the sub-stations, whereby the machines can be re-connected to the network after a shutdown without being automatically disconnected by the overload which would otherwise be thrown upon them

Lt.-Col. W. A. Vignoles, D.S.O., M.I.E.E., borough electrical engineer, informs us that a scheme for the removal of the original boilers to make room for modern ones and the provision of a 5,000-kW turbo-generator is being prepared.

First Railway Electrification in India.

The Great Indian Peninsula Railway's Bombay Suburban System.

THE first railway electrification scheme in India was successfully inaugurated at Bombay on February 3rd, 1925; in declaring the first section open, Sir Leslie Wilson, Governor of Bombay, paid a tribute to the Tata Hydro-Electric Companies, which, by providing the power, had assisted the realisation of the project,

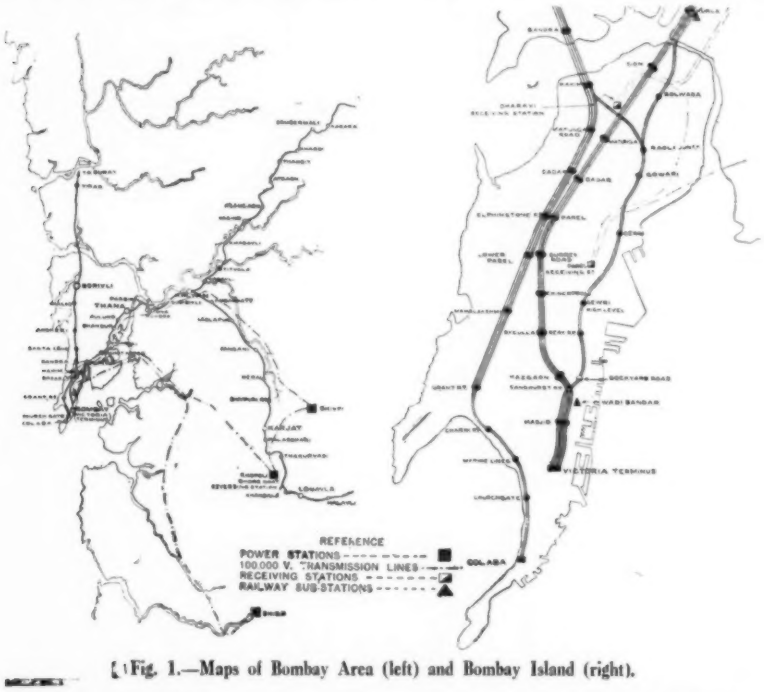


Fig. 1.—Maps of Bombay Area (left) and Bombay Island (right).

The electrification of that section of the Great Indian Peninsula Railway forming the Bombay suburban system has been under consideration for some years. In 1913 Messrs. Merz and McLellan, consulting engineers, of London, reported on the possibilities, but the scheme was suspended at the outbreak of the war and it was not until 1922 that the work was begun. The initial scheme comprises the electrification of the 9-mile harbour branch of the G.I.P.R. from Victoria station terminus to Kurla, just across the causeway that links the two islands of Bombay and Salsette (see fig. 1). The electrification of the main line is to be carried through as far as Thana, 19 miles out, which portion is expected to be completed by July, 1926, and finally by July, 1927, it is hoped that the Thana-Kalyan section will be in operation; the distance from Bombay to Kalyan is 33 miles and, in addition, the branch line known as the Mahim Chord, connecting with the Bombay, Baroda, and Central India Railway at Mahim, will probably be ready in July. The present passenger traffic on the harbour branch is very small, as the line is used chiefly for the carriage of goods from up-country to the docks, but the area through which the line runs is being developed by the Bombay Improvement Trust, and with the idea of dealing with the passenger traffic the line has been extended into Victoria terminus by the construction of a viaduct over the main line. The electrification was undertaken not only on account of the saving in working costs thereby obtainable, but because the capital outlay for electrical equipment was found to be considerably less than that needed for steam operation owing to the heavy gradient leading up to the viaduct over the main line. The Great Indian Peninsula Railway will have running powers over the

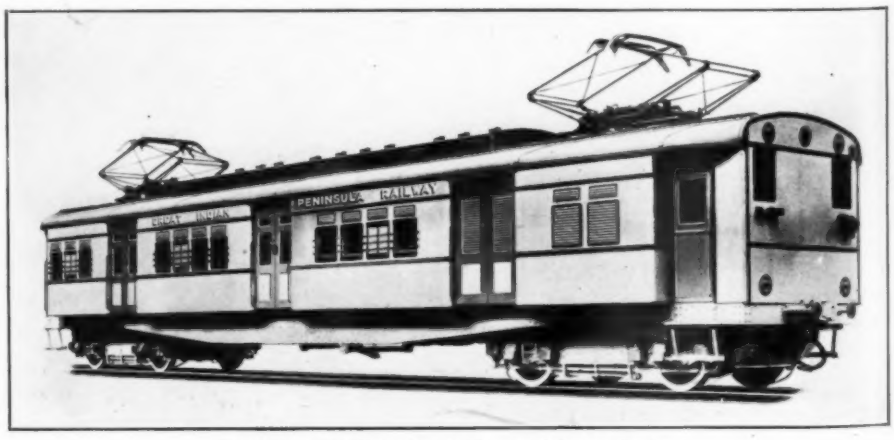


Fig. 2.—All-steel Motor Coach : Bombay Suburban Service.

Bombay, Baroda, and Central India Railway from Mahim to Bandra, nine miles from Victoria terminus, where a large amount of suburban traffic originates.

Electricity is purchased from the Tata Co., whose hydro-electric stations are situated some fifty miles from Bombay in the Western Ghats, and is transmitted at 100,000 volts, 50 cycles, to receiving stations at Dharavi and Kalyan, while a receiving station at Parel is used mainly for supplying cotton mills. The voltage is stepped down to 22,000 volts at the receiving stations, and the power is transmitted to the Wadi Bunder and Kurla railway sub-stations from Dharavi by means of 3-core cables, and from Kalyan by overhead lines to Thana and Kalyan. It is also intended to supply power to the workshops at Matunga and Parel, thereby enabling the railway company to shut down two small steam power stations which are now used to supply the locomotive, carriage, and wagon workshops. The metering for the Kurla and Wadi Bunder sub-stations will be done at Dharavi, while the supply to the Thana and Kalyan sub-stations will be metered in the stations themselves. In order to obtain the simultaneous maximum demand of all the sub-stations, which is necessary for purposes of payment for power consumed, the meters are of the printometer type, synchronised by clocks.

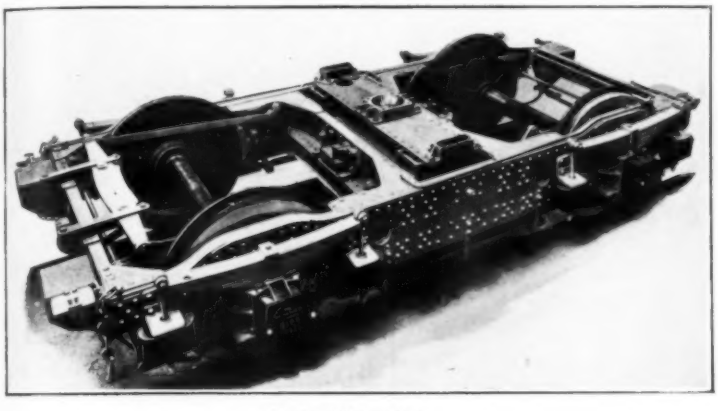


Fig. 3.—Motor Bogie.

The 22,000-volt cables from Dharavi to Wadi Bunder and Kurla are in duplicate, being paper-insulated, lead-covered, with single-wire armouring and laid direct in the ground. The section is 0.2 sq. in. from Dharavi to Parel and 0.15 from Dharavi to Kurla and from the workshops to Wadi Bunder. Both cables are laid in one trench, and the route follows the railway line as nearly as possible. The soil of Bombay Island attacks cables, and special precautions have been taken with the waterproof covering for protecting the armouring wires and lead; the cables are placed in pipes where they pass under the railway tracks, and also where they enter sub-stations, in order that they can be withdrawn without disturbing the permanent way, and the section of the copper is increased at such points to balance its smaller current-carrying capacity. The carriage and wagon workshops at Matunga will be supplied by a separate cable from Dharavi.

In the first instance, sub-stations have been provided at Wadi Bunder and at Kurla, each containing two 2,500-kW rotary converters for supplying the harbour branch; for the suburban service on the main line two sets of the same capacity will be installed at the Thana and Kalyan sub-stations, and one additional set will be installed at Wadi Bunder and at Kurla, which arrangement will provide a spare set in each sub-station under normal conditions. Each 2,500-kW set consists of 750-volt machines coupled in series giving 1,500 volts, d.c., and has been specially designed with high overload capacity for short periods; protection against short circuits is provided by high-speed circuit breakers.

Auxiliary transformers are provided in the sub-stations stepping down from 22,000 to 2,200 volts for supplying the railway stations and yards by means of a 3-phase overhead line carried on the track structures.

Both the 22,000- and 2,200-volt switchgear is armour-clad, compound-filled, and manually operated, with single busbars, while the 1,500-volt d.c. switchgear is mounted on a steel framework with stonework partitions.

The new harbour branch rolling stock is of the all-steel type designed by Messrs. Robert White & Partners. The width of the 68-ft. long coach is 12 ft., being the new standard dimension adopted by the Railway Board, and all internal fittings were made at the railway company's carriage workshops at Matunga. The eight-coach train has a seating capacity of 874 passengers.

For the main-line suburban service a large number of available passenger coaches of modern design have been equipped for use as trailers, with new motor coaches.

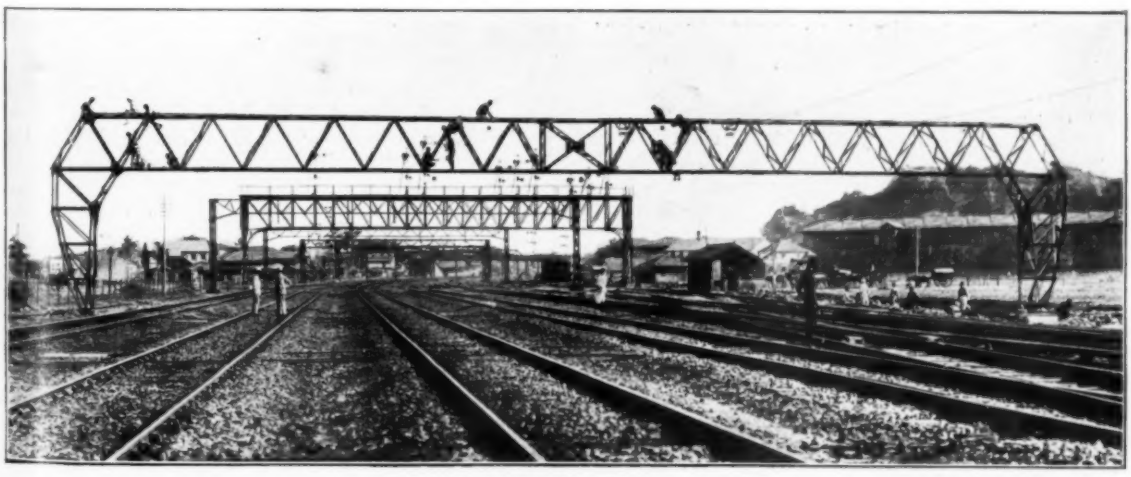


Fig. 4.—Eight-Track 3-Pin Structure.

Normally trains of eight coaches will be run consisting of two units, each comprising one motor coach and three trailers. For the present 13 units have been provided at a cost of £254,000, with which it is proposed to provide a service totalling 350,000 train miles per year. Each motor coach is equipped with four motors of 275 h.p. on the one-hour rating, two of which are connected permanently in series to allow for pairs of motors being controlled on the usual series-parallel sys-

tem. During the monsoon period the tracks may be flooded to a depth of 2 ft. 6 in., and consequently the motors had to be so designed as to enable them to run totally enclosed for short periods; the arrangement comprises valves on each end of the motor, which can be turned by means of a special spanner. The motors are carried in the ordinary way by suspension bearings on the bogie axle and by a nose supported on springs, fig. 3.

The control is the all-electric cam-shaft system developed by the English Electric Co. A motor generator supplies power at 120 volts for the control circuits, lighting, and fans. Vacuum brakes are used, and the two pantographs per motor coach are arranged for vacuum operation so as to avoid the necessity of a separate compressor. The sanding gear is of the gravity type controlled by electrically-operated valves.

Direct current at 1,500 volts is collected by the trains from overhead equipment of the single catenary type. The route mileage of track equipped in the first place is 12 miles, and the addition of the sidings makes a total of 28 miles of single track. The final scheme extending as far as Kalyan, however, will comprise four tracks as far as Kurla and two tracks from there on to Kalyan. The total route mileage of the complete suburban electrification scheme on these sections will be 45 and the single-track mileage 128.

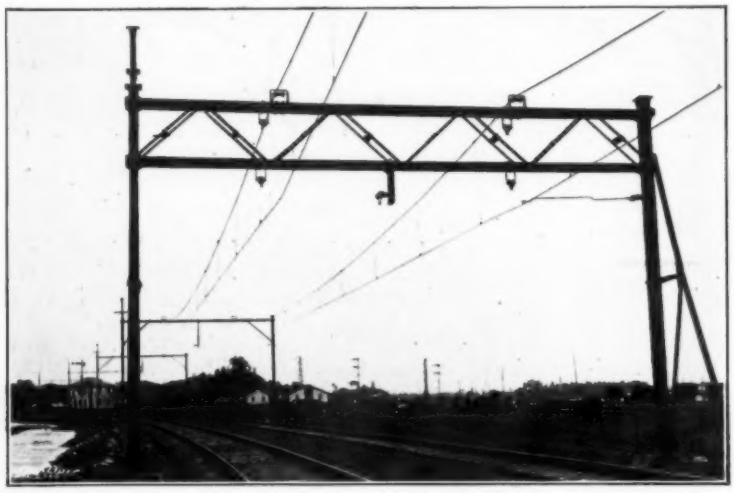


Fig. 5.—Typical Two-Track Equipment.

On those parts of the route where there are four tracks and the preliminary electrification requires two tracks only, the steel structures are designed to span all four tracks in order to reduce the additional expenditure required at a later date, figs. 4 to 6. It has been found necessary to have special structures with a span of 129 ft. in certain cases where it is impracticable to place intermediate supports between tracks. At Victoria terminus a span of 200 ft. would have been required in order to include all the tracks, and it was decided to equip this section with span wires on account of the remodelling of the station, which is still in progress, involving slewing some of the tracks. The span wires are carried by catenary wires and suspended between towers about 50 ft. high.

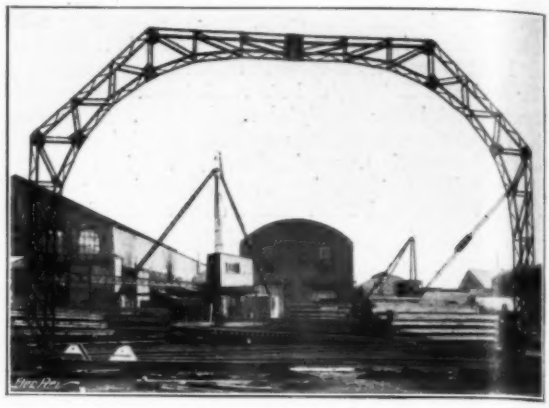


Fig. 7.—Viaduct Overhead Structure.

The 1,728-ft. long steel viaduct at Wadi Bunder carrying the harbour branch over the main line consists of two parallel structures each carrying one track. In order to allow for the relative movement of the two halves, the structures carrying the track equipment are designed in the form of a three-hinged arch, fig. 7.

The normal spacing of the structures throughout is 220 ft., and intermediate pull-offs are used on curves having less than 4,800 ft. radius. Anchor structures approximately half a mile apart are arranged so that the catenary and the contact wire overlap for a length of one span. The catenary and contact wires are anchored rigidly, no automatic tensioning arrangements being provided, and double insulation is used throughout. The catenary has 37 strands of 0.115 in. diameter copper, and the contact wire is of the grooved type having a section of 0.25 sq. in., giving a total copper section of 0.625 sq. in. per track. The formation of "hard spots" due to the action of the panto-

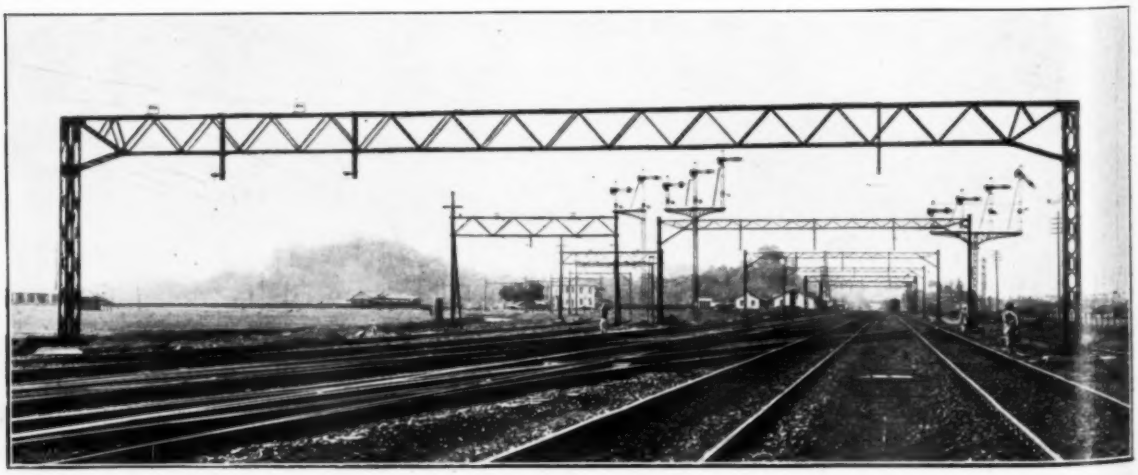


Fig. 6.—Six-Track Overhead Structure.

graphs is to some extent prevented by the heavy type of contact wire used.

Special cranes were provided and construction trains, consisting of out-of-date passenger stock, were fitted up in the railway company's workshops for use in the erection of the overhead equipment. Working platforms were built on the tops of the coaches, while the interiors were utilised as foremen's offices and stores.

The return current passes through the running rails, which have two bonds per rail joint of the solid-head type expanded into holes in the web of the rail, and are installed underneath the fishplates in order to prevent theft. The fishplates are of a special design in order to give the required clearance.

It was found possible to place the contracts for the whole of the plant in Great Britain, and below is a list of the principal contracts, a number of which included the erection of the plant by the contractors :—

Cables: Callender's Cable & Construction Co., Ltd.

Track bonds: British Insulated & Helsby Cables, Ltd.

Permanent-way overhead equipment and electrical equipment of coaches: English Electric Co., Ltd.

Motor bogie trucks and rolling stock: Cammell, Laird & Co., Ltd.

Rotary converters, with transformers: Metropolitan-Vickers Electrical Co., Ltd.

Switchgear: Ferguson, Pailin, Ltd.

Transformers for station lighting: Johnson and Phillips, Ltd.

Sub-station cranes: Herbert Morris, Ltd.

Steam cranes for erecting permanent-way equipment: John Birch & Co., Ltd.

Metering equipment: British Thomson-Houston Co., Ltd.

Contracts Open and Closed.

(*Continued from page 258.*)

Open.

Darlington.—February 25th. Electricity Works. Trolley omnibuses and reconstruction of overhead equipment. (February 6th.)

Egypt.—CAIRO.—March 25th. Telephone materials. Tenders to Inspecting Engineer, Queen Anne's Chambers, Broadway, Westminster.

Grimsby.—February 23rd. Electricity Department. Street lighting, posts and fittings. (See this issue.)

Greenock.—February 17th. Corporation. Electric lighting installations at 180 houses. Schedules from Office of Public Works.

India.—February 25th. Burma Railways Co., Ltd. Induction motor and starting pillar. (See this issue.)

Latvia.—RIGA.—February 23rd. Marine Department. Two/four electrically-driven cranes.*

London.—H.M. OFFICE OF WORKS.—February 18th. Steel conduits and fittings for electric wiring. (February 6th.)

HAMMERSMITH.—February 18th. Electricity Department. Twelve months' supply of stores, including electrical goods, insulated wires, meters, l.p. cable, &c. (January 30th.)

KENSINGTON.—March 5th. Board of Guardians. New internal telephone installation for the Marloes Road Institution. (See this issue.)

METROPOLITAN ASYLUMS BOARD.—February 25th. Alterations and additions to the fire alarm installation at Long Reach (Smallpox) Hospital. (See this issue.)

Manchester.—February 18th. Electricity Committee. Mercury-arc rectifying equipment. (Spec. No. 90). Specification from Mr. S. L. Pearce, manager, Electricity Department, Town Hall.

February 16th. Board of Guardians. 250-shirt washing machine, electrically driven, for Withington Institution, Nell Lane, West Didsbury. Particulars from Mrs. Firth.

Tramways Committee. February 18th. Permanent way points, tongues, crossing and hardened steel centres, also general stores. Mr. H. Mattinson, general manager, 55, Piccadilly, Manchester.

Portsmouth.—Electricity Department. One 6,000-kW turbo-alternator, with condensing plant, two 30,000-lb. per hour capacity water-tube boilers, with steel bunkers and economisers. (February 6th.)

Rochdale.—February 18th. Gas and Electricity Committee. Electricity sub-station, Silk Street, Sudden. Mr. F. H. Rudd, engineer and manager, Electricity Works, Dane Street.

Salford.—February 23rd. Electricity Department. One 1,500-kW rotary converter, with transformer and starting gear complete. (February 6th.)

South Africa.—JOHANNESBURG.—April 6th. South African Railways and Harbours. One 5-ton and three 4-ton electrically-operated portal cranes.*

South Shields.—February 16th. Electricity Supply Department. One 30-ton overhead electric travelling crane.

February 25th. One 1,000-kW rotary converter, with transformer, &c. (February 6th.)

Torquay. — February 28th. Electricity Department. Steam, feed, exhaust, drain and other piping for Newton Abbot power station. (See this issue.)

Transylvania.—TIMISOARA.—March 26th. Municipal Electricity Works. Turbo-generator, Scott transformers, h.p. feeder and accessories.*

Uruguay.—MONTEVIDEO.—March 5th. State Electricity Works. Steel and phosphor bronze wire, steel and copper bars and sheets.*

March 9th. 4,500 metres g.i. water tubes and 47,115 fittings for same.*

March 10th. Miscellaneous goods (including flexible steel cable, &c.).*

March 16th. Porcelain insulators and brackets.*

Warrington.—February 16th. Electricity Department. Motors and transformer. (January 30th.)

Wigan. — February 23rd. Tramways Department. Scraping and painting the tramway standards. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Barnes.—Electric Lighting Committee. Accepted:—

One 500-kW rotary or motor converter, with transformer and switchgear.—General Electric Co., Ltd.

Birmingham.—Salvage Department. Accepted:—

Twelve 5-ton "Garrett" refuse collecting electric vehicles.

Birkenhead.—Tramway Committee. Accepted:—

880 yd. of .2-in. cable and 880 yd. of .0045-in. cable (£310).—W. T. Henley's Telegraph Works Co., Ltd.

Bradford.—Tramways Committee.—

12 sets tramcar gear wheels and pinions (£172).—The Equipment and Engineering Co.

Electricity Committee :—

One 500-kW automatic converter and switchgear, Four Lane Ends sub-station.—A. Reyrolle & Co., Ltd.

Traction feeder switchboard.—Bertram Thomas.

Two automatic switchgear equipments for Odsal and Thornbury sub-stations.—Metropolitan-Vickers Electrical Co., Ltd.

One Jeffrey portable belt conveyor for Valley Road station.—Hugh Wood and Co., Ltd.

Chesterfield.—Electricity Committee. Accepted:—

Cable.—Macintosh Cable Co., Ltd. (£433); British Insulated & Helsby Cables, Ltd. (£171).

One "Weir"-type large boiler feed pump.—T. W. Ward, Ltd.

Dartford.—Urban Council. Accepted:—

E.h.p. switchgear and cable and d.c. switchgear (£838).—Johnson and Phillips, Ltd

Dublin.—Great Northern Railway Co. of Ireland. Accepted:—

Dry cells.—Edison Swan Electric Co., Ltd.

Eastbourne.—Electricity Committee. Accepted:—

H.p. cable for 12 months.—Craigpark Electric Cable Co., Ltd.

Glasgow.—Tramways Committee. Accepted:—

D.c.c. wire.—Siemens Bros. & Co., Ltd.

Transformers.—Metropolitan-Vickers Electrical Co., Ltd.

B.T.H. B.18 controllers.—E. J. Walsh & Co.

Welding plant.—Scholey Construction Co., Ltd.

Electric crane for Barrland Street yard.—Butters Bros. & Co.

Electricity Committee. Recommended :—

Overhead crane at Kelvinside sub station (£700).—Alexander Jack & Co., Ltd.

The committee has adjusted the balance still to be paid to Messrs. W. T. Glover & Co., in connection with their 1919 contract for the supply of h.p. cable, at £1,400.

Hull.—Telephones Committee. Accepted:—

Cable (£307).—Siemens Bros. & Co., Ltd.

Switchboards (£257).—British L. M. Ericsson Manufacturing Co., Ltd.

India.—DELHI.—A contract has been secured by Waygood Otis, Ltd., of 25 electric push-button lifts at Government House (Viceroy's Palace) and the Imperial Legislative Assembly at Delhi.

BOMBAY.—Municipal Council. Accepted :—

Five 50-b.h.p. d.c. motors complete with switchgear, for working the refuse manipulators at Carnac Bridge depôt (Rs. 10,410).—Crompton and Co., Ltd.

Leeds.—Electricity Committee. Accepted:—

Cable.—W. T. Henley's Telegraph Works Co., Ltd. (£1,128). Enfield Cable Works Co., Ltd. (£627). Macintosh Cable Co., Ltd. (£446).

Tramways Committee. Accepted :—

Gear wheels (£431).—National Steel Foundry (1914), Ltd.

Pinions (£157).—Electro-Mechanical Brake Co., Ltd.

Manganese steel castings (£1 17s. per cwt.).—Edgar Allen & Co.

Points and crossings and layouts.—Hadfields, Ltd., Edgar Allen and Co., Ltd., and Titan Trackwork Co., Ltd.

Liverpool.—Electricity Committee. Recommended:—
Coal-conveying plant at Lister Drive power station (£15,275).—R. Dempster & Sons, Ltd.

London.—METROPOLITAN ASYLUMS BOARD.—Works Committee. Recommended:—
Installation of electric light, power, telephones, &c., at Tooting Bec Hospital extension.

Read & Partners, Ltd. (Recommended.)	**£1,601**
T. Clarke & Co., Ltd.	1,633
E.B.H. Syndicate, Ltd.	1,720
Electrical Contracts & Maintenance Co.	1,882

Alterations and extensions to electric lighting at Western Hospital.

T. G. Jackson	£551
S. Reed & Sons, (Recommended.)	575
E.B.H. Syndicate, Ltd.	586
W. E. Brister	625
Read & Partners, Ltd.	643
W. H. Gaze & Sons, Ltd.	686
Wilkins Electrical Works, Ltd.	720
F. G. Mounter	746
Toy & Winslow	815

LONDON COUNTY COUNCIL MAIN DRAINAGE COMMITTEE. Accepted:—
Repair of suction and delivery valves, Deptford pumping station.—Union Electric Welding Co. (£69); Amersham Welding Co. (£90); British Arc Welding Co., Ltd. (£98); Premier Electric Welding Co. (£123)

BERMONDSEY.—Electricity Committee. Accepted:—
50 watertight switches and fuses.—Universal Electrical Mfg. Co., Ltd.

METROPOLITAN RAILWAY STORES DEPARTMENT. Accepted:—
Vacuum traction lamps for train lighting.—Metro-Vick Supplies, Ltd.

SOUTHERN RAILWAY STORES DEPARTMENT. Accepted:—
"Cosmos" vacuum lamps.—Metro-Vick Supplies, Ltd.

LONDON GENERAL OMNIBUS CO., LTD. Accepted:—
"Cosmos" vacuum m.l. lamps.—Metro-Vick Supplies, Ltd.

SOUTHWARK.—Electricity Committee. Recommended:—
Reconstruction of a turbine set (£3,875).—General Electric Co., Ltd.

CITY CORPORATION.—Lands Committee. Recommended:—
One public address system No. 3, to be installed in the Guildhall, including wiring eight microphones or transmitters, and the necessary projectors, &c. (£542).—Western Electric Co., Ltd.

ST. MARYLEBONE.—Electric Supply Committee. Recommended:—
Additional louvres on five sections of the new fan-draught cooling tower (£290).—Clyne Engineering Co., Ltd.

Malvern.—Urban Council. Accepted:—
Alterations and improvements to complete the switchgear at the electricity works.—Ferguson, Pailin, Ltd.

Sheffield.—Electric Supply Committee. Accepted:—
43 panels of 11,000-V, 3-phase, c.h.p. sub-station switchgear (£7,975).—A. Reyrolle & Co., Ltd.
Eighteen 100-kVA, single-phase, outdoor-type transformers (£2,122).—British Electric Transformer Co., Ltd.
Two natural draught water-cooling towers for the Neepsend generating station (£8,326).—Davenport Engineering Co., Ltd.

Tramways Committee. Accepted:—
500 steel tramcar tires (£1,619).—Brown, Bayleys, Ltd.

Stoke-on-Trent.—Corporation. Accepted:—
Switchgear at the Burslem sewage works (£280).—Metropolitan-Vickers Electrical Co., Ltd.

Stretford.—Electricity Committee. Accepted:—
288 tube economiser (£1,090).—E. Green & Son, Ltd.
Turbine circulating pump (£198).—Rees Roturbo Co., Ltd.

Wimbledon.—Electricity Committee. Recommended:—
Two 200-kVA transformers in connection with the supply of electricity (£336).—Foster Engineering Co., Ltd.
One water-tube boiler, complete with superheater, economiser, soot-blowers, mechanical stokers, coal elevator and bunker, draught plant, steel chimney, and necessary foundations (£15,836).—Vickers-Spearing Boiler Co., Ltd.

Forthcoming Events.

Faraday Society.—Monday, February 16th. At Burlington House, W.1. At 8 p.m. Ordinary meeting.

Paisley Association of Engineers.—Tuesday, February 17th. At 16, High Street, Paisley. At 7.30 p.m. Paper, "Notes on the Necessity for Private Generating Plant," by Mr. W. B. Scott.

Institution of Electrical Engineers.—Thursday, February 19th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "Electricity in Mines," by Major E. I. David.
(Mersey and North Wales (Liverpool) Centre).—Monday, February 16th. At the University, Liverpool. At 7 p.m. Lecture on "Modern Electric Lighting Practice," by Mr. W. E. Bush.
(North-Western Centre).—Tuesday, February 17th. At the Engineers' Club, Manchester. At 7 p.m. Paper on "The Design of Electrical Plant, Control Gear, and Connections for Protection Against Shock, Fire, and Faults," by Mr. H. W. Clothier.
(Scottish Centre).—Tuesday, February 17th. At the Freemasons' Hall, Edinburgh. At 7.45 p.m. Faraday Lecture on "World-wide Radio Telegraphy," by Prof. G. W. O. Howe.
(South-Midland Centre).—Wednesday, February 18th. At the University, Birmingham. At 7 p.m. Paper on "The Design of Electrical Plant, Control Gear, and Connections for Protection Against Shock, Fire, and Faults," by Mr. H. W. Clothier.
Friday, February 20th. At the City Council Chamber, Birmingham. At 7 p.m. Joint meeting with the Local Centres of the Institutions of Civil and Mechanical Engineers. Address by the president, Mr. W. B. Woodhouse.
(Sheffield Sub-Centre).—Wednesday, February 18th. At the Royal Victoria Hotel, Sheffield. At 7.30 p.m. Address by the president, Mr. W. B. Woodhouse.
(North-Midland Students' Section).—Tuesday, February 17th. At the Technical College, Bradford. At 7 p.m. Paper. "Criticisms of Wiring Rules," by Mr. D. H. Sanderson.

British Industries Fair.—Birmingham. February 16th to 27th.

Royal Institution of Great Britain.—Thursday, February 19th. At 21, Albemarle Street, W. At 5.15 p.m. Lecture on "The Properties and Structure of Quartz," by Prof. Sir Wm. Bragg, F.R.S.

Junior Institution of Engineers.—Friday, February 20th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette on "Inverted Tooth-chain Drives," by Mr. J. M. Seddon.

Manchester Electro-Harmonic Society.—Friday, February 20th. At the Albion Hotel, Piccadilly, Manchester. At 7 p.m. Concert.

Institution of Production Engineers.—Friday, February 20th. At the Society of Motor Manufacturers and Traders, 83, Pall Mall, S.W. At 7.30 p.m. Paper on "Grinding Practice," by Mr. H. A. Dean.

British Electrical Development Association.—Friday, February 20th. At Caxton Hall, Westminster, S.W. At 7.30 p.m. Paper on "Power and Heat in the Home," by Mr. J. W. Beauchamp.

Electrical Trades Commercial Travellers' Association.—Friday, February 20th. At St. Bride's Institute, Bride Lane, E.C. At 7 p.m. First general meeting.

No. 4 (Newhaven) Co., L.E.E., and the 23rd A.A.S.S., R.E. (Overseas.—Saturday, February 21st. At "The Two Chairmen," Dartmouth Street, S.W.1. At 6.30 p.m. Sixth annual dinner and re-union.

Notes.

Progress of the Sheffield Undertaking.—Mr. S. E. Fedden, general manager of the Sheffield Corporation electricity Department, in a recent lecture dealt with the rise and progress of the undertaking, which, he said, now employed 900 men. When the Neepsend power station was decided upon in 1902 a continuous kiln was built and they manufactured millions of bricks and practically built the whole of the place out of the site. In connection with the undertaking there were now about 400 sub-stations and 600 miles of cable. The annual revenue was £833,945, and the total number of consumers 22,000, while the total capacity of installations connected with the mains was 302,000 h.p.

Proposed Birmingham Canal.—The Birmingham Canals Committee has under consideration a report upon the improvement of inland water communication between Birmingham and the Manchester Ship Canal and the Mersey. Two schemes are put forward, but the one which is recommended for acceptance provides for the linking-up of Wolverhampton and the Weaver Navigation, *via* the Staffordshire and Worcestershire Canal, the Trent and Mersey Canal, and through the Potteries to Northwich. The estimated capital cost of the proposals is about £6,600,000. This sum includes electricity and water supplies, but not the purchase prices of the existing canals and land. It is anticipated that the Government would make a grant towards the cost of the scheme if it were approved.

Smoke Abatement.—Included in the 1925 spring programme of the Chadwick Public Lectures is an address on March 9th by Lord Newton on "The Necessity for Legislation with regard to Smoke Abatement."

Progress of Southern Railway Electrification.—One of the first of the newly-electrified sections of the Southern Railway to be put into service will be the line from Waterloo to Leatherhead, which will function in addition to the steam services on the Brighton section. The electrified line will probably be ready for service in July, when it will be possible to run three trains an hour to Leatherhead. To meet the new conditions it is proposed to close the Leatherhead South-Western station and concentrate upon the Brighton section station for passenger traffic.

Wireless for Ships' Lifeboats.—Two of the motor-driven lifeboats of the R.M.S. *Orbita*, which have been built by Messrs. Harland & Wolff, Ltd., of Liverpool, have been equipped with the type of radio apparatus described in our issue of November 21st, 1924, and the accompanying illustration shows one of the lifeboats on her trials at Liverpool. The transmitter is of the quenched-spark type, supplied with

Ship's Lifeboat fitted with Radio Apparatus.

power by a generator driven by a petrol engine, and the receiver, with which dull-emitter valves are used, can be employed for "all-round" reception or, by a simple adjustment, for direction finding. For the latter service the small rectangular frame aerial mounted near the bow of the boat is used in conjunction with the main aerial. Four of these installations have been purchased from the Marconi International Marine Communication Co., Ltd., by Messrs. Harland & Wolff.

X-Ray Equipment.—Mrs. W. B. Street, of Cowdenbeath, is to present to Dunfermline and West Fife Hospital an up-to-date X-ray apparatus in memory of her daughter.

Engineers' Club (London).—During February twenty meetings of engineering and allied bodies are being held at the Club.

Local Societies.—BIRMINGHAM ELECTRIC CLUB.—Mr. F. R. Unwin, A.M.I.E.E., delivered his presidential address on January 23rd. He commenced with a review of the events leading up to the formation of the club and a survey of its history. The speaker made reference to the fact that at about the time of the club's inception several engineers in the country were speaking of "the saturation point" having been reached; there were still far too many people in the electrical industry with a narrow and pessimistic outlook. Mr. Unwin recalled that in the first year of the club's history an influential member stated that Birmingham was one of the worst-lighted towns in the country, and New Street station in this respect was without parallel, and expressed the opinion that in spite of the enormous development already referred to, this statement regarding Birminham street-lighting was substantially true to-day. In order that the work of the Electricity Commissioners might proceed as quickly as possible, it was necessary for the whole of the electrical industry to give them every assistance. The address concluded with a general expression of opinions regarding possible future developments in homes, offices, and factories, and in rural districts.

Electrical Power Engineers' Association.—Before the Derby and District Section of this Association, at Nottingham on Wednesday, March 4th, Mr. Percy E. Rycroft, M.I.E.E., will give a lecture, illustrated with lantern slides, on "Some Tendencies in Modern Steam Raising Practice."

A Report upon the Sydney Electricity Undertaking.—Mr. S. L. Pearce, who was to leave Australia for this country early in January, has made a number of recommendations to the Sydney City Council after a close examination of the Council's electricity supply undertaking. He approves the present practice of obtaining supplies in bulk from the Railway Commissioners, and recommends that the present agreement should be renewed upon its expiry in 1929. He further says that the Council should have adopted a system when it was first recommended by the general manager of the undertaking (Mr. Forbes Mackay) in 1916-17. He does not approve the alternative of purchasing a coal mine and erecting a station adjacent to it. He considers that the station should be as near as possible to the centre of the load. Of the sites inspected for a power house, Mr. Pearce considers that either the Botany Bay or George's River sites would be preferable to any site on the South Coast. The unsatisfactory condition of the Pyrmont power house is attributed to the failure of contractors to fulfil their guarantees for the supply of new plant, and to breakdowns in plant made by reputable firms. Mr. Pearce draws attention to the need for unified control of electrical development in the State, and the Government is said to be considering the appointment of an electricity commission.

The report concludes with a recommendation that the salaries of the principal officials should be increased, and that the recommendations of the general manager should be acted upon more promptly than they have been in the past.

Swiss Water Transport and Power Exhibition.—We have received a prospectus of the International Exhibition for Inland Navigation and the Utilisation of Hydraulic Power which is to be held at Basle next year. The exhibition is divided into two principal groups. The first, that dealing with inland navigation, is subdivided into four groups. The second group, dealing with the utilisation of hydraulic power, consists of three sections. The first subdivision is devoted to general information as to the utilisation of hydraulic power. The second section deals with the utilisation of inland waterways for the purpose of power production. In this section complete power station plant, methods of regulating and correcting waterways; dams, weirs, basins, canals, pressure conduits, as well as power station superstructures, will be exhibited. The last subdivision takes account of the mechanical plant such as turbines, pumps, generators, motors and similar appliances. Numerous firms and public bodies have already expressed interest in the exhibition and have placed themselves in touch with the management. The prospectus may be obtained free of charge from the organising secretary of the Exhibition in Basle.

Teachers' Vacation Courses.—The Board of Education is making arrangements for the annual vacation courses to be held in the summer of 1925. The Electrical Engineering and Engineering Science courses will be held at Birmingham and Oxford. Teachers who desire to attend the courses must make application on the Board of Education form 106e U before March 21st.

Electric Vehicles in Germany.—According to a recent official return there are now 1,414 private electric cars in use in Germany, as compared with 1,102 a year ago. During the same period the number of electric commercial vehicles in use in that country increased from 1,644 to 1,852.

Appointments Vacant.—Electrical engineer (£600) for the Government of the Gambia Public Works Department. Junior assistant to the borough electrical engineer for the Corporation of Ealing Electricity Supply Department. Charge shift engineer for the Yorkshire Electric Power Co. (See our advertisement pages to-day.)

Institution Notes.

Institution of Electrical Engineers.—INFORMAL MEETING.—On February 2nd a further discussion was held on the new "Wiring Regulations." The very short notice of the meeting affected the attendance, and in consequence Mr. F. Pooley, who was in the chair, was not successful in obtaining many new contributions to the discussion. Mr. J. Coxon said there was general agreement on the need for some control of the work that was being done, especially in house wiring, but he felt that the regulations were calculated to provide only the best class of work, and it would have been better to frame rules to determine the minimum conditions for general safety. He thought the regulations, not being compulsory, should be termed "Recommendations."

Mr. A. H. Allen said that, generally speaking, he had a dislike for introducing earths into rooms of a private house where formerly there were none, and where no danger from shock existed. His inclination was to simplify house-wiring to the cheapest system compatible with safety.

Mr. C. J. Lawrence pointed out the false sense of security that might be given by the three-pin plug as there might be no indication that the earth wire was disconnected.

Mr. Ll. B. Atkinson said the criticism had not been very effective; it all boiled down to three or four main questions. Cheapness was what all sections of the industry desired, but the final consideration must be the satisfaction and safety of the public. It was better to have regulations from a sympathetic body within the industry than much more drastic rules along the lines of the Home Office Regulations which the State might feel compelled to impose. The criticism on the score of cost had been shown to be of no moment; only in the most disadvantageous conditions would the additional cost be 5 per cent. The earthing stipulation had been misunderstood by one speaker after another. The regulations provided for portable apparatus having an earth terminal, so that it might be earthed when taken into situations that were elsewhere described as requiring earthed apparatus. References to wiring on the Continent and in the United States ignored the important fact that much higher pressures were used in England.

The other speakers were Messrs. J. R. Bedford, H. J. Cash L. J. Gooch, R. Grierson, A. F. Harmer, S. W. Melsom, F. Pooley, F. C. Raphael, W. R. Rawlings, W. A. Ritchie, E. S. Ritter, and H. T. Young.

PRESENTATION.—At the meeting of the Institution last week, after reference to the deaths of Mr. C. H. Wordingham and Mr. O. Heaviside, members standing in silence, Mr. W. B. Woodhouse (president) announced the grateful acceptance by the Council of a statuette of the late Sir Joseph Swan, which had been presented to the Institution by Mr. R. K. Morcom, C.B.E. Dr. S. Z. de Ferranti, in speaking of Swan's achievements, pointed out that before his work there was no electric light. Swan invented the electric lamp quite independently and at the same time, or it might have been earlier, than Edison. It was of interest to note that the statuette had been executed by Swan's daughter, Mrs. Morcom. Mr. R. K. Morcom said it was fitting that the Institution should have the statuette, and its acceptance had given both himself and his wife great pleasure.

KELVIN LECTURE.—The 16th Kelvin lecture was delivered on February 5th by Mr. J. H. Jeans, M.A., D.Sc., F.R.S., who dealt with his subject of "Electrical Forces and Quanta" in a most interesting and able manner. Sir Oliver Lodge proposed a vote of thanks, which was seconded by Dr. A. Russell, and carried with enthusiasm.

Iron and Steel Institute.—ANNUAL MEETING AND DINNER.—The annual general meeting will be held on May 7th and 8th at the Institution of Civil Engineers. The annual dinner will take place at the Hotel Cecil on May 7th.

AUTUMN MEETING.—The autumn meeting is to be held in Birmingham from September 9th to 11th.

CARNEGIE RESEARCH FUND.—In March the Council will be prepared to consider applications from members for grants from the Carnegie Fund in aid of research on some subject of practical importance relating to the metallurgy of iron and steel, or allied subjects; the results of such work must be communicated to the Institute in the form of a report.

Institute of Transport.—CONGRESS AND DINNER.—The annual congress is to be held in London from May 13th to 16th. On the mornings of the first three days, meetings will be held at the Institution of Electrical Engineers for reading and discussing papers. The afternoons will be devoted to visits to places of transport interest, and for the concluding day a special visit is in contemplation.

The Institute dinner will take place at the Hotel Cecil on Wednesday, May 13th.

EXAMINATION SCHEME.—The first Institute examination will be held in London in April or May, 1926. Copies of syllabuses of the graduateship and associate membership (traffic section) examinations are available for members, and in co-operation with the London School of Economics a course of lectures is now being delivered at the school premises.

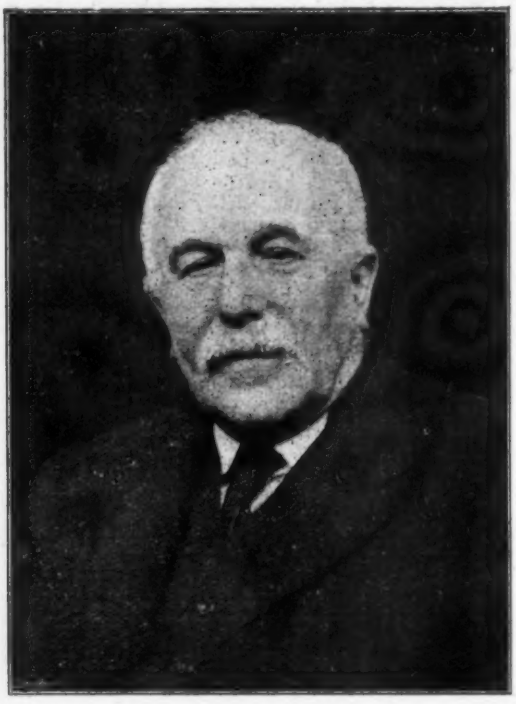
Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

The three candidates already mentioned here for the presidency of the American Institute of Electrical Engineers have all withdrawn, as Prof. MICHAEL I. PUPIN, professor of electromechanics at Columbia University, New York City, has been nominated, and the three other candidates have endorsed his candidacy. The *Electrical World* says that Prof. Pupin's election is virtually assured.

The *Australasian Electrical Times* records that Mr. EDWARD HIRST, chairman and managing director of the British General Electric Co., Ltd., was married on December 16th at the Congregational Church, Strathfield, to Miss MARJORIE FORSYTH STEWART, daughter of Prof. J. Douglas Stewart, of the University of Sydney.

Mr. P. WALKER, whose photograph accompanies this note, has just retired from the post of general works manager of



E. Victor Barton] [*Erith.*

Mr. P. Walker,

who recently retired from the position of general works manager at Callender's Works at Erith.

Callender's Cable & Construction Co.'s works at Belvedere, after being in the service of the company for 35 years.

As was announced in this column last week, Mr. E. N. DICKINSON, M.I.E.E., is retiring on superannuation at the end of this month from the position of power engineer and superintendent of the Greenwich Power Station of the London County Council, a position which he has occupied since 1906. He was in charge of the erection of the plant originally installed, now approaching a capacity of 50/60,000 kW, and showing operating costs which are among the lowest of any station in London. Mr. Dickinson is not retiring altogether, but is going to devote himself to consulting engineering with special reference to power station work, including the more economical combustion of fuel. He has our own best wishes as well as those of many other electrical and engineering friends in entering upon this new stage of his career. His address for the present will be 6, Ulundi Road, Blackheath, S.E.3. Telephone: Greenwich 60.

Tunbridge Wells Town Council, on February 4th, decided to increase the salary of the borough electrical engineer, Mr. R. N. TORPY, by £150 per annum, to £950, as from April 1st, 1924, the salary to cover all extensions and other work in connection with the undertaking, whether falling within the ordinary duties of a borough electrical engineer or not. At a previous meeting the Lighting Committee recommended that Mr. Torpy should be granted an honorarium of £600 for additional services rendered in connection with extensions at the electricity works, but this was referred back for further consideration.

The Industrial Australian and Mining Standard states that Mr. J. W. ROBINSON, who has been appointed manager of the broadcasting station which the Queensland Government intends to erect in Brisbane, was appointed honorary radio inspector by the Federal Government in 1922.

DR. JAMES HOPWOOD JEANS, F.R.S., secretary of the Royal Society, and Sir WILLIAM HENRY ELLIS, G.B.E., have been appointed to be members of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research.

Mr. STEER, Secretary to the Railways Commissioner, has accepted the appointment of general manager of the Brisbane tramways for seven years. Mr. Nelson, the present acting general manager, will be appointed chief engineer, and Mr. S. L. Quinn, secretary of the trust, will be appointed secretary and assistant general manager.

Mr. J. E. MALLALIEU, of Blackpool, who has been elected president of the East Lancashire and Cheshire Division of the Motor Trade Association, served his apprenticeship in the Corporation Electricity Department, afterwards joining Messrs. Dick, Kerr & Co., of Preston, by whom he was sent to India and Burma on constructional engineering work. He was, for some years, chief engineer to the city of Mandalay.

Alderman GEORGE BALL, for 19 years chairman of the Stockport Corporation Electricity Committee, has retired, and on January 31st he was presented by the members of the Committee and the staff and employés of the electricity works with a silver épergne dish and an illuminated address. The presentation was made by the electrical engineer, Mr. R. Lomax.

Mr. MUNFORD, who has retired after being for 51 years traffic superintendent of the Portsmouth Corporation Tramways, has been presented by the administrative staff with an armchair.

Mr. D. ALLISON has been appointed manager of the Manchester Branch of the Western Electric Co., Ltd., and Mr. H. S. Hayden has been transferred to Birmingham for special work.

Mr. FRANK J. BROWN, C.B., C.B.E., who retired from the General Post Office on February 5th, after 38 years' service, had been very closely connected with the development of telephones, cables, wireless and broadcasting in that very lengthy period. He has been Assistant Secretary in charge of the Government cables and wireless services for the past six years and played a prominent part in connection with the Imperial Communications Committee, with the Peace Conference of 1919 (where he was expert adviser on telegraph communications to the British Delegation), as Senior British Delegate at the Washington Conference on Electrical Communications and so on. His connection with broadcasting was not only administrative, as he was a member of the broadcasting committee which Sir Wm. Joynson Hicks appointed in 1923 and was also a member of the permanent Broadcasting Board at the Post Office. Mr. Brown has retired under the age limit, but he has no intention of being idle for he is identified with a new and important development in the world of submarine

Bassano, Ltd.] [*London*

Mr. Frank J. Brown,

who has retired from the G.P.O. and become the Director of the new Association of Submarine Telegraph Companies.

telegraphy which is just announced. An association of Submarine Cable Companies is being formed, in which most of the well-known cable companies are interested, for dealing with matters which are of common concern to them all. The organisation will not be in any sense an amalgamation or trust, but will operate on lines similar to those followed by the Railway Companies' Association. There will be a committee to look after its affairs with Mr. Brown as the Director of and Adviser to the Association.

We are pleased to learn that Mr. GUY BURNEY, managing director of the Sterling Telephone & Electric Co., Ltd., who underwent an operation for appendicitis on Wednesday last week, is making satisfactory progress towards convalescence. The operation was entirely successful.

Owing to the death of Mr. H. W. Sullivan, the late chairman of the company, Messrs. H. W. Sullivan, Ltd., have appointed Lieut.-Comdr. W. G. BISHOP, O.B.E., R.N.Ret'd., who has been his immediate assistant for 2½ years, to be managing director. The company will be carried on in the same manner, and with the same staff as heretofore.

The directors of the Madras Electric Supply Corporation, Ltd., and the Madras Electric Tramways (1904), Ltd., have made the following appointments:—Mr. J. F. JONES, M.I.E.E., Agent and Chief Engineer; Mr. A. J. POWELL, Commercial Manager; Mr. E. DE B. ELPHICK, A.M.I.E.E., Chief Assistant Engineer; and Mr. H. C. RENNICK, A.M.I.E.E., Distribution Engineer.

With further reference to the salary of its borough electrical engineer (ELEC. REV., January 16th), the Barrow-in-Furness Town Council has increased this to £850 per annum, to include war bonus. The salary of the tramway manager is to be advanced to £600, including war bonus.

The Glasgow Corporation Committee on Cleansing has recommended Mr. GEORGE Y. MILNE, A.M.I.E.E., for the appointment of clerk of works for the new refuse disposal works at Govan, at a salary of £500 per annum.

Mr. ARTHUR GOODWIN, of Messrs. C. A. Vandervell & Co., Ltd., of Acton, has been appointed chairman of the Accessories and Components Manufacturers' Committee of the S.M.M.T. vice Mr. W. Peto, who has held this important position for the past four years.

At the eighth annual concert of the London Station Engineers, No. 1 Branch, which was held at Peckham on Friday last, Mr. P. L. RIVIERE, M.I.E.E., electrical engineer to the L.C.C. Tramways, and the L.C.C. representative on the Joint Industrial Council (Electricity Supply), supported by Mr. W. J. Webb, made a presentation of a silver tea service and a cheque to Mr. T. J. Belcher. Mr. Belcher's colleagues employed in the electrical branch of the tramways, in this way marked his retirement, due to ill-health, after 21 years' service with the L.C.C. Tramways.

Mr. W. J. King, the branch president, was in the chair, and among the 350 present were:—Mr. T. L. Horn, M.I.E.E., distribution engineer, L.C.C. Tramways; Mr. N. H. Thomas, A.M.I.E.E., assistant distribution engineer, L.C.C. Tramways; Mr. H. E. Blackiston, A.M.I.E.E., sub-station superintendent, L.C.C. Tramways; and Mr. E. A. Glover, A.M.I.E.E., mains superintendent, L.C.C. Tramways.

The Salaries and Wages Committee of the Edinburgh Town Council recommends that the salary of the Deputy Tramways Manager be increased from £650 to £800 per annum by two annual increments of £100 and £50, and that of the Tramways Traffic Superintendent from £550 to £600.

The Electric Railway and Tramway Journal states that Mr. ALFRED BAKER, general manager, Birmingham Corporation Tramways, is again visiting Greece, in connection with the Athens tramways.

Mr. S. H. FOWLES, station superintendent, Sunderland Corporation electricity works, has been appointed technical assistant to the borough electrical engineer, Chesterfield. There were 93 applicants.

On Saturday evening, at the Collingwood Restaurant, Newcastle-on-Tyne, the staff and employés of Messrs. F. Reid Ferens & Co., presented Mr. ARTHUR ANDREWS, the managing director of the company, with a grandfather's clock. The presentation was made by Mr. G. C. Iveson, cashier, at a smoking concert presided over by Mr. E. W. Andrews, the manager of the Sunderland branch. The firm was established in 1875 for telegraph instrument work, and Mr. Andrews has been with it 31 years, 23 of them as a partner.

Mr. BERNARD SWIFT, B.Eng., A.M.I.E.E., has resigned his post as chief transformer designer to the Brush Electrical Engineering Co., Ltd., to take up the position of manager and head designer with the Yorkshire Electric Transformer Co., Ltd., Thornhill, Dewsbury.

Obituary.—MR. H. W. SULLIVAN.—Mr. H. W. Sullivan, to whose death and funeral we made reference in our last issue, joined the Telegraph Construction and Maintenance Co., Ltd., in 1870, and served a three years' apprenticeship with them, at the conclusion of which he joined the Eastern Telegraph Company, with whom, during a period of six years, he undertook the charge of the electrical arrangements of their Gibraltar station and assisted the late Mr. C. V. de Saute in the first successful duplex experiments on long submarine cables. The almost continuous ill-health that so seriously handicapped Mr. Sullivan's career, then made itself apparent, and he was invalided home, but with characteristic courage and determination he resumed his duties within a few months, and served with the staff afloat for two years. Rejoining the Telegraph Construction Company in 1879 he was assistant at many important cable laying undertakings, including the Ireland-Newfoundland, Singapore-Batavia, Lisbon-Madeira Duplicate, Suez-Aden Triplicate, Straits of Sunda and Mozambique-Zanzibar Duplicate. Subsequently Mr. Sullivan became associated with two French companies (La Compagnie Française des Cables Télégraphiques and La Société Industrielle des Téléphones), for whom he installed and organised a number of cable stations in various parts of the world. He served as electrician-in-chief and consulting engineer respectively during the manufacture and submersion of the last French Government cables between Marseilles and Tunis, and between the Australian Continent and New Caledonia. In 1897 Mr. Sullivan established himself in business in order to manufacture certain patented instruments, together with cable testing and telegraph signalling apparatus generally. The Universal Galvanometer which he invented and developed achieved instant and world-wide reputation, and the whole range of work which he produced showed in a marked way the predominating characteristic of the man, that of taking infinite pains. The business steadily increased in prosperity and reputation, and in its administration Mr. Sullivan exhibited that rare combination of firmness and tact that has guided it through many difficulties and endeared him to those who have had the pleasure of working under him. The valuable assistance rendered by Mr. Sullivan to the Government in the early days of the war, mainly in the development of wireless telegraphy, laid the foundations of an extensive connection with the Home and Foreign Governments, and with the expressed wish of providing for its continuance after his death, Mr. Sullivan in 1922 formed the business into a limited company with Lieut.-Comdr. W. G. Bishop, O.B.E., R.N.Ret'd., under whose management the business will now be conducted, on the board. During the last few years it became clear that his health was so impaired that he should take more rest from the continuous detail work entailed by the company's ever-expanding activities, but his determination to continue was unbroken and he died, as he would have wished, in harness.

F. D'Alessandri [*Rome.*

The Late Mr. H. W. Sullivan.

MR. ARNOLD WHITE.—Mr. Arnold White, whose death was announced in *The Times* of the 6th inst., was well known as a "publicist," a coloniser, an advocate of a strong Navy, and as "Vanoc" in the *Referee*, a weekly contributor of trenchant articles on the political and social events of the day. But so far as we can gather from the obituary references in the daily Press, the fact that he was a telephone pioneer has been forgotten. Arnold White was the first secretary of the Edison Telephone Co., of London. He assisted in the promotion of that company, and was active in the propaganda work which was then so necessary. *The Times* of May 10th, 1879, published a letter under the title of "The Economics of the Telephone" over the signature of "Arnold White." This letter set out the advantages likely to result from the adoption of the exchange system of telephonic communication already established in the United States. Mr. Arnold White's letter prompted a leading article in *The Times* on the same day. The article was sympathetic and well-informed. Interest was aroused, and a valuable step towards success obtained. After the amalgamation of the Edison and Bell Companies in 1880, Mr. White's telephonic activities ceased; he undertook the Jewish colonisation schemes of the late Baron Hirsch, and followed with those other public enterprises which are remembered whilst his telephonic experiences are forgotten. *The Times* says of him: "He early came to the conclusion that the world might be made better by encouraging efficiency and helping the fit, possibly even better than by caring for the weak, diseased and unfit. Naturally, therefore, the whole subject of colonisation attracted him." It may perhaps be permissible to infer that it was the desire for the encouragement of efficiency that prompted him to take an interest in the development of the then unknown telephonic exchange system.

MR. OLIVER HEAVISIDE.—On February 4th Mr. Oliver Heaviside, F.R.S., died in a nursing home at Torquay, aged 74. Mr. Heaviside was born in London in 1850, and served for some years on the staff of the Great Northern Telegraph Co. at Newcastle-on-Tyne, but retired in 1874, and spent the rest of his life in Devonshire, shunning publicity and living in solitude. He is therefore known to the present generation only by his works—but those works were of the very highest order of excellence. Mr. Heaviside was a mathematician of great brilliancy; a close student of Clerk Maxwell's electromagnetic theory, he evolved a mathematical system of his own by which he was enabled to carry his investigations much further in certain directions, particularly in connection with

The late Mr. Oliver Heaviside, F.R.S.

telegraphy and telephony. He demonstrated that the electrical characteristics of a telephone cable could be greatly improved by the addition of inductance—a proposition so directly contrary to the ideas then current that telephone engineers would have none of it. Not until Prof. Pupin corroborated his results and showed how his proposal could be carried into effect, by loading the cable with inductance coils, was it realised that Heaviside had been right all the time. Since then the principle of loading has been adopted on a very large scale, and has made trans-Continental telephony by overhead lines possible, besides greatly improving telephonic communication by cable between this country and the Continent, and between our chief towns.

Another notable achievement of Heaviside's was to demonstrate the possibility that Hertzian waves would travel round the curved surface of the earth instead of following a rectilinear path into space; he showed that, in accordance with Maxwell's theory, sea-water possessed sufficient conductivity to guide the waves at the lower end, and that there was probably an ionised layer in the upper regions of the atmosphere which would similarly guide the upper ends. This hypothetical ionised stratum is now generally known as the "Heaviside layer."

Mr. Heaviside for some time lived in extreme poverty, until, as the result of efforts made on his behalf, a small Civil List Pension was conferred upon him. He published several volumes embodying the scientific investigations which gained for him a world-wide reputation; but his merits were not generally recognised, except by the Royal Society, the Institution of Electrical Engineers (which made him the first Faraday Medallist), and other learned societies.

New Companies Registered.

W. G. Pearson & Sons, Ltd. (203,560).—Private company. Registered February 2nd. Capital, £6,000 in £1 shares. To acquire the business of accumulator manufacturers carried on by W. G. Pearson, G. P. Pearson, and E. B. Pearson at 869a, High Road, Leytonstone, Essex, and to carry on the business of accumulator manufacturers, general and electrical engineers, &c. The subscribers (each with one share) are:—W. G. Pearson, G. P. Pearson, and E. B. Pearson, all of "East Dene," Charteris Road, Woodford Green, electrical engineers. W. G. Pearson is permanent governing director. Qualification, 100 shares. Remuneration, of governing director, £2,000 per annum; of other directors, as fixed by the company. Secretary: G. P. Pearson. Solicitors: Sterns, 41, The Broadway, Stratford, E. Registered office: 869a, High Road, Leytonstone, Essex.

H. N. Robinson (Liverpool), Ltd. (203,518).—Private company. Registered January 31st. Capital, £1,000 in £1 shares. To carry on the business of manufacturers, repairers, exporters and importers of, contractors and factors for, and dealers in electrical and wireless instruments and appliances of all kinds, &c. The first directors are:—H. N. Robinson, 17, Dovedale Road, Mossley Hill, Liverpool, engineer; W. H. Kelsall, 5, Gresford Avenue, Newton, Cheshire, incorporated accountant. Qualification, £5. Remuneration as fixed by the company. Secretary: W. H. Kelsall. Registered office: 114, Penny Lane, Wavertree, Liverpool.

Barforth, Ltd. (203,515).—Private company. Registered January 31st. Capital, £1,000 in £1 shares. To carry on business as vendors of, and dealers in wireless and other scientific apparatus or accessories, musical or sound-emitting, producing or recording instruments, manuscripts, songs, books, or other printed matter, &c. The directors are:—P. Garton, 21, Maddox Street, W.1, solicitor; R. G. Sidford, 36, Southampton Street, Strand, W.C.2, incorporated accountant. Qualification, £50. Remuneration as fixed by the company. Solicitors: Garton & Co., 21, Maddox Street, W.1.

H. J. Stallworthy, Ltd. (203,589).—Private company. Registered February 4th. Capital, £200 in £1 shares (100 preference and 100 ordinary). To carry on the business of electrical engineers and contractors, &c. The permanent directors are:—H. J. Stallworthy (managing director), 37, Stanhope Road, North Finchley; E. G. Reavell, 29a, Archway Road, Upper Holloway, N.; J. Adam, 7, Pemberton Gardens, N.19. Secretary: E. G. Reavell. Solicitors: Percy Shortt & Cuthbert, 30, Norfolk Street, W.C.2. Registered office: 29a, Archway Road, Upper Holloway, N.19.

Compacto Electrical Engineering Co., Ltd. (203,584).—Private company. Registered February 4th. Capital, £1,000 in £1 shares. To adopt an agreement with H. Paul and to carry on the business of electrical engineers, makers of all kinds of electrical apparatus and appliances, rectifiers for charging electric batteries, and of resistances, &c. The first directors are:—H. Paul, address not stated; A. V. Blower, "Nethercourt," Carew Road, Ealing, W.13, gent.; R. H. Monnickendam, 12, Montpelier Road, Ealing, W.5, gent. Qualification, £100. Solicitors: Cooper, Bake, Fettes, Roche & Wade, 6 and 7, Portman Street, W.1. Registered office: 98 Chaplin Road, Willesden, N.W.2.

Johnson & Foster, Ltd. (203,593).—Private company. Registered February 4th. Capital, £1,000 in £1 shares. To carry on the business of electrical, radio, and mechanical engineers and contractors, suppliers of light, heat, sound, and power, ironfounders, tool makers, brassfounders, metal workers, boiler makers, dealers in machinery, wireless apparatus, &c. The first directors are:—E. Johnson (managing director), 16, Travis Place, Sheffield, electrical contractor; C. O. Foster (chairman), Cecil Road, Dronfield (both permanent, subject to holding 50 shares each). Secretary: F. Johnson. Registered office: 30, Division Street, Sheffield.

Adipsia, Ltd. (203,606).—Private company. Registered February 5th. Capital, £100 in £1 shares (50 preference and 50 ordinary). To carry on business as importers and exporters of, and dealers in merchandise of all kinds, and agents; to erect and maintain electric, hydraulic and other power plant and works; to supply power to consumers in the vicinity of the company's works, &c. The subscribers (each with one share) are:—C. Phelps, 53, White Horse Hill, Chislehurst, gent.; W. H. Johnson, 47, Endymion Road, Brixton Hill, S.W.2, gent. C. Phelps is the first permanent director and chairman, with £200 per annum as remuneration; remuneration of other directors, £100 each per annum. Qualification, 5 shares.

Official Returns of Electrical Companies.

Rotax (Motor Accessories), Ltd. (48,936).—Return dated December 16th, 1924. Capital, £506,500 in 253,250 ordinary and 253,250 preference shares of £1 each. 253,033 ordinary and 253,034 preference shares taken up. £168,650 paid on 93,650 ordinary and 75,000 preference shares. £337,417 considered as paid on the remainder. Mortgages and charges, nil.

B. Barnett (Electrical Engineers, Leyton), Ltd.—F. Loveridge, of 47, Ratcliff Road, Forest Gate, E.7, was appointed receiver and manager on January 21st, 1925, under powers contained in first mortgage debenture dated April 15th, 1924.

J. Hadden & Co., Ltd.—J. E. Percival, F.C.A., of 6, Old Jewry, E.C.2, was appointed receiver on January 26th, 1925, under powers contained in debenture dated September 13th, 1922.

Dispatch Engineering Co., Ltd.—Satisfaction in full on December 15th, 1924, of debenture dated April 16th, 1923, securing an unspecified amount.

Young & Co. (Hants.), Ltd., which name has since been changed to Wireless (Southampton), Ltd.—Particulars filed of £500 debentures authorised December 24th, 1924, charged on the company's undertaking and property, present and future, including uncalled capital (if any), the whole amount being now issued.

Cumberland Waste Heat Owners Co., Ltd.—Debenture dated January 23rd, 1925, to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Midland Bank, Ltd.

Wholesale Electrical Co. (1922), Ltd.—Issue on January 5th, 1925, of £2,300 debentures, part of a series already registered.

S. B. B. Co., Ltd.—Particulars filed of £1,000 debentures authorised by resolutions of December 29th, 1924, and January 13th, 1925, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £300.

Hamilton Bros., Ltd.—Debenture dated January 27th, 1925, to secure £1,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. B. Cecil, 32, St. Gabriel's Road, Cricklewood, N.W.6.

Mawdsleys, Ltd. (91,783).—Return dated December 29th, 1924. Capital, £20,000 in £1 shares. 18,937 shares taken up. £6,937 paid. £12,000 considered as paid. Mortgages and charges, £6,300.

Liverpool Electric Cable Co., Ltd. (71,099).—Return dated December 26th, 1924. Capital, £30,000 in £1 shares. All shares taken up. £7,833 paid. £22,167 considered as paid. Mortgages and charges, nil.

Agar Cross & Co., Ltd.—Trust deed dated January 19th, 1925, to secure £500,000 5½ per cent. debenture stock, constituting a specific charge on freehold land and buildings in the Argentine Republic and a floating charge on the company's undertaking and other property, present and future, including uncalled capital, subject to an indenture dated May 7th, 1913, securing £350,000 5 per cent. first mortgage debentures. Trustees: River Plate Trust, Loan and Agency Co., Ltd., 52, Moorgate, E.C.

A. C. Hamilton, Ltd.—Charge on the company's undertaking and property, present and future, dated January 20th, 1925, to secure £600. Holder: E. C. Trubridge, 134, Boulevard Brand Whitlock, Brussels.

City Notes.

The "Underground" Group.

The final dividends for the year ended December 31st have been declared by the members of this group. They are as follows:—

London Electric Railway Co.—Two per cent. on the ordinary shares, making 4 per cent. for the year, as in the previous year. The reserve fund receives £45,000 (as against £65,000), and £74,506 is carried forward (£111,537).

City & South London Railway Co.—Two per cent. on the consolidated ordinary stock, making 4 per cent. for the year, as in 1923. £25,000 is transferred to reserve (as compared with £36,000), and £18,766 (£28,783) is carried forward.

Central London Railway Co.—Undivided ordinary stock 2 per cent. (making 4 per cent.); preferred ordinary stock 2 per cent. (making 4 per cent.); and deferred ordinary stock 4 per cent. for the year. Similar dividends were paid for 1923. The amount placed to reserve is £40,000 (as against £49,000) and £85,884 is carried forward, as compared with £94,729.

Metropolitan District Railway Co.—Two per cent. on the ordinary stock, making (as in 1923) 3½ per cent. for the year. To reserve, £45,000 (£65,000); carried forward £69,230 (£84,088).

Underground Electric Railways Co. of London, Ltd.—Subject to the confirmation of the above dividends, and those of other concerns in which the company is interested, the full half-year's interest is to be paid on the 6 per cent. first cumulative income debenture stock and on the 6 per cent. income bonds, as in 1923. A balance of £126,600 is carried forward, as compared with £95,639 brought in.

The Associated Equipment Co. is paying no dividend for 1924, and the ordinary dividend of the *London General Omnibus Co.* is reduced from 9 to 6 per cent.

Traction and Power Securities Co., Ltd.

The annual meeting of this company was held on February 2nd, Mr. H. A. Vernet (chairman) presiding. In moving the adoption of the report and accounts, the Chairman said that as a result of the resolutions passed last year new articles of association had been adopted and the issued £8 shares had been divided into 5 per cent. cumulative preference stock and ordinary stock in the proportion of £5 and £3. During the year under review the directors had issued £300,000 4½ per cent. debenture stock, the annual cost of which was below the income from investments. Their foresight in holding back from investments in the United States had been justified by the recent rise of the sterling exchange. Another matter which had to be taken into account when considering American investments was the income tax which was a serious matter for British investors. An improvement had taken place in Continental affairs. The company had investments in Government loans in Austria, Czecho-Slovakia, Finland, Germany, Greece, Hungary, Rumania and the City of Greater Prague. These were attractive for the investment of reasonable amounts. The accounts for the year were on a somewhat different basis, but the earnings were equal to 13.72 per cent., less tax, on the ordinary stock. Part of the company's large holding in the Clyde Valley Power Co. had been disposed of during the year. The report and accounts were adopted and the recommended dividends, as reported in our issue of January 30th, were approved.

Dublin United Electric Tramways Co., Ltd.

The report for 1924 states that the amount available is £134,504 and interim dividends amounting to £23,400 were paid on August 8th, 1924. It is recommended that a dividend at the rate of 6 per cent. per annum be paid on the preference stock for the half-year ended December 31st, 1924, and that a final dividend at the rate of 7 per cent. per annum (making 8½ per cent. for the year), be paid on the ordinary stock; that £60,000 be set aside for renewal of track, and £5,000 for renewal of overhead line and cables. £15,279 is to be carried forward.

Fife Tramway, Light and Power Co., Ltd.

In the annual report the directors state that they may deem it desirable to ask the shareholders to sanction an increase in capital during the current year to provide funds for the development of the company's properties. For the year to December 31st, 1924, the trading profits of the undertakings owned and operated by the company amounted to £126,849. A dividend on ordinary shares of 8 per cent., less tax, is proposed. The directors regard the results as satisfactory, keeping in view the adverse operating conditions. During the year an issue of 240,000 7 per cent. cumulative preference shares and 40,000 ordinary shares was made, the proceeds of which were utilised in the repayment of the 7 per cent. debenture stock and towards the settlement of outstanding capital commitments. The premium of £4,000 upon the issue of ordinary shares has been placed to general reserve.

Belgian Companies.

At the annual meeting of the *Société des Tramways d'Ekaterinoslav*, held in Brussels recently, the directors reported that owing to the fact that all relations with Russia were cut off they had no news whatever of the working or condition of their electric tramway system in the town of Ekaterinoslav and could therefore present neither a report nor a financial statement.

In order to meet the increasing demand for electricity which is being experienced by the various companies in which it holds a controlling interest, the *Société Générale Belge d'Entreprises Electriques*, of Brussels, is increasing its capital from 25 to 50 million fr. Among other concerns, the *Société Générale* has a financial interest in the *Société Intercommunale Belge d'Electricité* and the *Bassin de Charleroi, Borinage, Nord, Est* and *Ouest* electricity supply companies in Belgium; in the *Société des Exploitations Electriques*, the *Société Énergie Electrique de Rouergue*, and the *Société Electrique du Nord*, in France; the *Società Ligure Toscana d'Elettricità*, and the *Società del Electricitta del Valdarno*, in Italy; and the *Société d'Entreprises Electriques en Pologne*, in Poland.

German Electrical Companies.

The *Siemens-Schuckert Company*, whose accounts have now been converted from a paper to a Reich mark basis, records net profits of 490,000 marks for 1923-24, which amount has been carried forward.

The *Siemens and Halske Co.*, which has issued its balance sheet in Reich marks, reports gross profits of 3,321,000 marks for 1923-24, and net profits of 2,649,000 marks, which sum has been carried forward.

The *German Electricity Works* (Garbe, Lahmeyer and Co.), of Aix-la-Chapelle, reports that the year 1923-24 was under the influence of inconsiderate competition. The working expenses were largely increased through the taxes which had to be paid in occupied territory, so that the selling prices realised only partly covered the expenditure despite the adoption of all measures of economy.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

County of London Electric Supply.—£500,000 7 per cent. redeemable debenture stock.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Newcastle-upon-Tyne Electric Supply Co.—465,000 new ordinary shares of £1 each, partly paid and fully paid, Nos. 1,297,682 to 1,762,681.

Power Securities Corporation, Ltd.—The accounts for the past year show a gross income of £91,389 and a net balance of £74,832, to which is added £4,100 brought forward, making £78,932. The 7 per cent. preference dividend absorbed £27,125; £20,000 is transferred to reserve; a dividend on the ordinary shares at the rate of 6 per cent. is recommended (as in 1923); leaving £8,557 to be carried forward.

Still Engine Co., Ltd.—By order of the High Court, Chancery Division, meetings of debenture holders, holders of "A" shares, and ordinary shareholders will be held at Winchester House, Old Broad Street, E.C., on February 18th for the purpose of considering and, if thought fit, approving a scheme of arrangement proposed to be made. Copies of the scheme can be seen at the office of the company, 7, Princes Street, Westminster.

City of Buenos Ayres Tramways (1904), Ltd.—The report for the past year shows a net revenue of £78,439 (including £9,464 brought forward). Interim dividends absorbed £46,500; a final dividend of 1s. 3d. per share (making 5 per cent. for the year) requires £15,500; £5,000 is transferred to the general amortization fund; and a balance of £11,439 is carried forward.

London Electric Supply Corporation, Ltd.—The directors have declared the following dividends in respect of the half-year ended December 31st:—Old preference shares, 3s. per share (making 6 per cent. for the year); new preference shares, 3s. per share (first dividend); ordinary shares 1s. 2.4d. per share (making 10 per cent. for the year). The previous year's ordinary dividend amounted to 10 per cent.

Tottenham District Light, Heat, and Power Co.—The dividends for the latter half of 1924 are as follows:—Preference stock, at the rate of 5 per cent. (making 5 per cent. for the year); "A" stock, at the rate of 8 per cent. (making 8 per cent.); and "B" stock, at the rate of 6½ per cent. (making 6½ per cent.).

St. James' and Pall Mall Electric Light Co., Ltd.—The directors recommend the following balance dividends for the past year:—Preference shares, 3s. 6d. per share; ordinary shares, 7s. 6d. per share, with a bonus of 5s. per share, making 17½ per cent. for the year, as in 1923.

London and Suburban Traction Co., Ltd.—The directors state that they are unable to recommend the payment of a dividend on the 5 per cent. cumulative preference shares for 1924. Last year the shares received 2½ per cent. on account of arrears.

North Metropolitan Electric Power Supply Co.—The 1924 dividend on the ordinary shares is 10 per cent. as in the previous year. The amount to be placed to reserve is raised from £100,000 to £132,718, and £7,297 is to be carried forward, as against £6,210 brought in.

Uxbridge and District Electric Supply Co., Ltd.—Out of the profits of 1924 it is proposed to transfer £15,000 to the depreciation fund, to pay a dividend of 8 per cent. on the ordinary shares, and to carry £1,590 forward.

Potteries Electric Traction Co., Ltd.—The directors announce that the final dividend on the 5 per cent. cumulative preference is postponed.

Liverpool Overhead Railway Co.—A dividend at the rate of 5 per cent., less tax, has been declared on the preference shares in respect of the year ended December 31st last.

Westinghouse Brake and Saxby Signal Co., Ltd.—A dividend of 1¼ per cent. is recommended, and a profit of £13,924 from investments is added to the reserve for contingencies.

Scottish Power Co., Ltd.—A dividend of 1s. 7 1/5d. per share, less tax, has been declared on the ordinary shares.

Stocks and Shares.

MONDAY EVENING.

THE tone of the Stock Exchange is steady, though on balance the disposition of prices tends to the easier side in a good many of the markets. This is due to an absence of public interest ascribed to various causes which have been already mentioned here. The Home Railway markets are heavy, owing to the disturbed state of the atmosphere in the labour world. Undergrounds gave way by reason of the disappointment felt with the reports which came out a few days ago and which show smaller amounts carried to reserves, the dividends being maintained. The figures, however, are not good, more especially in view of the fact that the British Empire Exhibition should have provided the transport undertakings with a substantial amount of fresh traffic.

Electricity supply stocks are very firm, and most of the rises recently achieved amongst manufacturing shares are held.

The Metropolitan-District Company, paying 2 per cent. on its ordinary stock, makes the year's dividend for 1924 3½ per cent. This is equal to recent expectations, although two or three months ago most people had looked for an increase to 4 per cent. The carry-forward of £69,000 is £15,000 less than that of a year ago. The London Electric, the City & South London, and the Central London all distribute the same dividends, making 4 per cent. for the year, as were paid in 1923, though in each case the carry-forward is reduced. The City and South London has some justification in showing less satisfactory figures in that the line was closed for a good part of the time.

The London General Omnibus Company announces 3 per cent. free of tax, making 6 per cent., free of tax, for the year, which goes against 9 per cent., free of tax, in the previous twelve months. Underground Electric ordinary shares receive no dividend, though the 6 per cent. income bonds get their full 6 per cent., free of tax, the same as before. The London and Suburban Traction Company cannot pay even the 2½ per cent. that was declared in respect of arrears a year ago. The North Metropolitan Electric Power pays 10 per cent., the same rate as before, and puts an extra £32,700 to reserve, carrying forward £7,300, which is better than that of the corresponding period. This is the only member of the group to show any improvement.

Prices of the stocks reflect the disappointment felt with the figures. East London ordinary is unchanged at 5, and the company's prior-charge stocks are steady. Metropolitan has risen 2, on the increased dividend. But Districts are down a point, Underground £10 shares are 2s. 6d. lower, and Bus "A" at 8s. 6d. show a fall of 1s. 6d.

In the lighting list, Westminsters have slipped back to 11½. London Electrics at 35s. are 6d. down, on the dividend being maintained at 10 per cent., the same as that for each of the two previous years. Bournemouth & Poole ordinary continue to mount, the shares being ½ higher at 56s. 3d. Yorkshire Electric hold their advance at 31s. Whitehall debenture, with a rise to 98, reflects the investment demand that absorbs, unceasingly, this class of stock.

In the cable market, the Eastern group is better, advances having occurred in Eastern Extensions, Globes and Eastern ordinary. Westerns remain unchanged at 17. An Association of submarine cable companies is in course of formation. Automatic Telephones have further risen to 33s. 9d., being a gain of 3s. 9d., but Internationals stick at 25s., the price having scarcely budged throughout the time during which Automatics have been going ahead so sharply. The reason for this is that in the International company there are 300,000 deferred shares which rank for dividend after 6 per cent. has been paid on the ordinary. Jutland Telephone 5½ per cent. bonds firmed up to 101¼.

Marconis are better at 35s., ex the 1s. dividend. Canadians spurted to 5s. 9d., to react to 5s. 3d., which left them better on the week. Radio common, after being 12½, recovered to 12¾; the preferred are 10½. A considerable business in United River Plate new shares resulted in the price being advanced to 27s. premium.

In the traction group, Brazilian Tractions, ex a dollar dividend, are marked down 1. Mexico Tramways Fives have stiffened to 72, and the Mexican Power issues continue good. Anglo-Argentine 5 per cent. debenture is better. Amongst the home descriptions, British Electric Tractions are again 1 up. Yorkshire (West Riding) gave way to 1¼ ex dividend, the speech of the chairman at the annual meeting being regarded as none too stimulating: Sir Herbert Leon remarked that the increasing motor competition resulted last year in a fall of £9,000 in the company's traffic receipts.

Enfield Cables ordinary are a strong market, and the price has further risen to 53s. 6d. The preference are 1s. up at 25s. Metropolitan-Vickers debenture is higher at 75¼. A gain of 1/16 in Callenders, taking the price to 3 1/16, is the principal change in this particular section. Babcocks are still 55s. The new Armstrong 6½ per cent. third debenture, issued at 99½, is now 100, having been down to 98 since it came out at the end of last year. Iron and steel shares show a wavering tendency on fears of a coal strike. The rubber market is neglected, disappointment being general in the market at the failure of the raw produce to make headway in Mincing Lane.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Num. £	Dividend. 1922.	Dividend. 1923.	Price Feb. 9. 1924.	Rise or fall.	Yield. p.c.
Bournemouth and Poole ...	1	10	18	21⅛	+ ½	4 12 8
Brompton Ordinary	1	12	10	1⅝	—	*5 6 8
Charing Cross Ordinary	1	14	14½	46/3	—9d.	6 5 7
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	10	12	37/6	—	6 8 0
City of London	1	15	15	49/6	—	6 1 0
do. do. 6% Pref. ...	1	6	6	23/6	—	5 2 2
Clyde Valley	1	8	8	28/-	—	5 14 4
County of London	1	10	15	53/3	—	5 14 1
do. do. 6% Pref. ...	1	6	6	23/6	—	5 2 2
Edmundson's Ordinary	1	7	7	22/-	—	6 7 3
do. 7% Pref. ...	1	6	6	22/6	—	6 4 5
Elec. Supply Corporation ...	1	8	10	27/-	—	7 8 5
Kensington Ordinary	5	12	14	11½	—	6 4 5
Lancs. Light and Power ...	1	Nil	7½	27/-	—	5 11 1
London Electric	1	10	10	35/-	—6d	5 14 3
do. do. 6% Pref. ...	5	6	6	5⅝	—	5 9 1
Metropolitan	1	8½	10	1⅞	—	5 6 8
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5	5½	24/3	—	4 10 7
Newcastle-on-Tyne Ordinary ...	1	2½	6	1⅛	—	5 6 8
do. 5% Pref. ...	1	5	5	18/9	—	5 6 8
do. 7% Pref. ...	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	9⅜	—	6 4
North Met. Elec. 6% Pref. ...	1	6	6	1⅛	—	5 6 8
St. James' and Pall Mall ...	5	14½	17½	13¼	—	6 14 3
South London	1	11	15	2⅞	—	6 3 0
South Metropolitan Pref. ...		7	7	1¼	—	5 12 0
Urban Ordinary	1	—	4	12/9	—	4 5 4
do. 6% Pref. ...	1	5	6	19/6	—	6 3 1
Westminster Ordinary	5	12	15	11¼	— 1/16	6 13 4
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	1	—	7 10 0
Yorkshire Elec.	1	8	8	31/-	—	5 3 4

HOME RAILS.

Central London Ord. Assented	Stock	4	4	74	—	5 8 1
Metropolitan	,,	3½	4	81	+2	6 3 7
do. District	,,		3½	53½	—1	6 10 10
Underground Electric Ordinary	10	Nil	Nil	2¾	— ¼	Nil
do. do. "A" ...	1	Nil	Nil	8/6	—1/6	Nil
do. do. Income	Bonds		6	101	—	*5 18 10

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	104	—	5 15 4
do. Def.	,,	1½	1½	23½	—	6 7 8
Automatic Telephone	1	Nil	3	1¹³/₁₆	+ 1/16	1 15 6
Chili Telephone	5	6	6	5⅞	—	*5 4 4
Cuba Sub. Ord.	10	7	7	7	—	10 0 0
Eastern Extension	10	10	10	17½	+ ½	*5 14 3
Eastern Tel. Ord.	Stock	10	10	173½	+1	*5 15 3
Globe Tel. and T. Ord.	10	10	10	17⅞	+ ⅛	*5 13 8
do. do. Pref.	10	6	6	11¼	—	5 7 10
Great Northern Tel.	10	24	22	£0	—	7 6 8
Indo-European	25	7	7	32½	—	*5 6 1
Marconi	1	15	10	1¾xd	+9d.	5 14 3
Marconi Marine	1	10	10	1⅛	—	8 17 10
Oriental Telephone Ord. ...	1	12	12	1⁷	—	*6 8 0
United R. Plate Tel.	5	8		6⅜	—	*6 0 9
Western Telegraph		10	10	17	—	*5 17 8

HOME AND FOREIGN TRAMS, &C.

Anglo-Arg. Trams First Pref. ...	5	12½	5½	9½	—	8 9 1
do. do. 2nd Pref. ...	5	5½	6	9	—	10 0 0
do. do. 5% Deb. ...	Stock	5	5	76½	+1	6 10 9
British Electric Traction Ord. ...	,,	5	6	101½	+1	5 18 3
do. do. 6% Pref. ...	,,	6	6	106½	—	5 14 9
Brazil Traction	100	4	4	58xd	—	6 18 0
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	,,	5	96/-	91½	+2	*5 5 0
do. do. Deferred	,,	8	129/5	113½	—	*5 14 4
do. do. Deb.	,,	4½	4½	81½	—	5 4 4
Lond. & Sub. Trac. 5% Pref. ...	1	5	2½	6/-	—6d.	Nil
London United Tram. Deb. ...	Stock	4	4	51½	—	7 15 4
Mexico Trams, 5% Bonds ...	—	Nil	5	73	+1	6 19 0
Mexican Light Common ...	100	Nil	Nil	24	—	Nil
do. Pref.	100	Nil	Nil	60	—	Nil
do. 1st Bonds ...	—	5	5	67	—	7 9 3
Yorkshire (West Riding) ...	1	—	5	1¼xd	—⅛	4 9 0

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	20	12	55/-	—	*4 7 3
British Aluminium Ord.	1	5	5	32/-	—	3 2 6
British Elec. Transformer Pref.	1	Nil	Nil	17/6	—	... ...
British Insulated Ord.	1	15	15	3	—	5 0 0
Brush Ord.	1	10	10	24/6	—	8 3 4
Callenders	1	15	15	3 1/16	+ 1/16	4 17 10
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	5	Nil	¼	—	... ...
Edison-Swan	4/-	7½	10	6/6	—	6 3 0
do. 5% Deb.	Stock	5	5	81½	—	6 0 3
Electric Construction	1	10	10	32/6	—	6 3 1
Enfield Cable, Pref.	1	7½	7½	1½	+1/-	6 0 0
English Electric	1	8	5	20/3	—	4 18 9
do. do. Pref.	1	6	6	21/6	—	5 11 7
Gen. Elec. Pref.	1	6¼	6¼	23/3	—	5 11 10
do. Ord.	1	5	5	22/3	—6d.	4 10 0
Henley	1	15	15	3	—	5 0 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	10	5	17/6	—	*5 14 3
Johnson & Phillips	1	5	5	1⅛	—	3 18 3
Met-Vickers, Ord.	1	12½	8	1¼	—	6 2 0
do. Pref.	2	8	8	2½	—	6 0 0
Siemens Ord.	1	5	—	1⅛	— ⅛	4 4 0
Telegraph Construction	12	20	20	27	+ ½	*4 9 0

*Dividends paid free of Income Tax.

The World's Largest Engineering Project.—III.

The Undertaking of the Southern California Edison Co.

By T. B. ROSS.

REVIEWING the financial side of the Southern California Edison Co., the latest information obtained by the writer dated from September, 1923, to July, 1924, just prior to his departure from California. During that period financial conditions on the Pacific Coast were tending towards a slump, particularly in the Southern area around Los Angeles.

In September, 1923, at a meeting of the company's shareholders, authorisation was obtained for increasing the capital and bonded indebtedness as follows:—

Original 5 per cent. first preferred issue of $4,000,000 to stand. To increase the 7 per cent. preferred stock from $36,000,000 to $60,000,000, to be named series "A."

To issue, if and when found desirable, 6 per cent. preferred stock, to be known as series "B," up to $40,000,000.

To issue similarly 5 per cent. preferred stock, as series "C," up to $21,000,000. To increase the common stock from $60,000,000 up to $125,000,000.

John B. Miller, the president, could have had but little conception of the enormous undertaking which his pioneer efforts of that period were to bring into being. About 1897 Mr. Miller was probably putting up the greatest fight for the company in all the time he has been its guiding spirit. Apparently, capitalists in America were not very partial to hydro-electric propositions "out West" thirty years ago, and this is not to be wondered at when one considers the populations of to-day and then—Los Angeles at that time had a population of about 75,000, whilst to-day it exceeds 1,000,000. The few towns of any prominence, such as Pasadena, Long Beach, Redlands, and other smaller towns were entirely cut off from each other, and maintained their own small municipal plants. It was for the merging of such outlying concerns that Mr. Miller first started the Edison Electric Co. (now the S.C.E. Co.), and from a small beginning he has had the great satisfaction, enjoyed by but few pioneers, of seeing his early efforts crowned by the company's huge accomplishments of to-day.

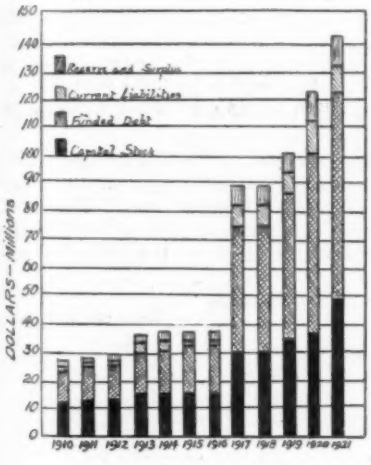


Chart A.—Capitalisation and Debt.

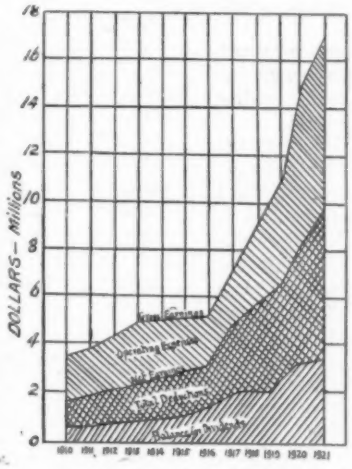


Chart B.—Earnings and Expenses.

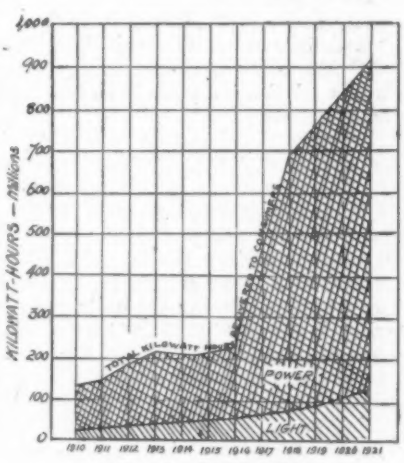


Chart C.—Growth of Sales.

The above-mentioned changes resulted in increasing the total authorised capital stock from $100,000,000 to $250,000,000.

In addition to the increased capital stock, the shareholders authorised their directors to increase the company's bonded indebtedness to $250,000,000, the new bonds to be sold at such interest rates as the financial market might warrant and in quantities and at certain times as the directors might deem necessary. In this matter it is of interest to note that under the Public Utilities Act of California no bonds or stocks may be sold by the company except under the authority of, and at prices fixed by, the State Railroad Commission; also the revenue derived from such sales can only be applied to the building of additional power plants and other properties or to retiring other bonds. Reference to the accompanying financial chart "A" in this article will indicate to those interested in the financing of the Edison project, the growth of capital and expenditure from 1910 to the year ending December 31st, 1921. [The writer was unable to obtain a later annual report of the company than that published for 1921, from which Chart "A" is reproduced.]

In the early days of the company's operations, Mr. In his first financial efforts for the company, after great difficulties and many disappointments, Mr. Miller succeeded in interesting one of the best known bankers on the Pacific Coast, Mr. William R. Staats, and two or three of the latter's friends in his company's project, and at a later date two of the big Eastern Banking Houses. The result was that he obtained for the company its first loan. Originally settled for $5,000,000, the amount was increased to $10,000,000, half of which was to be expended over a period of from 10 to 15 years. But at the end of the first five years the whole amount of $10,000,000 had been used up. To-day the annual budget of the company exceeds two and a half times the amount of its first big loan.

But even to-day the company appears to be experiencing some difficulty in obtaining the requisite funds to carry on its project. Just prior to leaving Los Angeles, the writer read a report in the *Los Angeles Examiner* of July 18th, 1924, from which the following extracts are given for the benefit of readers:—

"That the Edison Company is chargeable with a lack of foresight in not having provided steam generating plants to meet the present power shortage was the outstanding point in yesterday's proceedings on the

company's rate application before Railroad Commissioner Harley Brundige.

"Over this issue a sharp exchange occurred between F. C. Finkle, former chief hydraulic engineer of the Edison, and R. H. Ballard, general manager of the company.

"In a series of questions, Finkle sought to show that the rainfall records of Southern California are such as to indicate the probable inadequacy of purely hydro sources for electrical generation. H. A. Barre, chief executive engineer of the corporation, came under the same sort of fire.

"'Is not the Edison Company a sound financial institution?' asked Finkle of Ballard.

"'It will be if the Railroad Commission grants our application for relief,' said the witness.

"'But if you fail to pass on your loss in revenues due to power shortage to your customers, then it will not be a sound financial institution?'

"'I don't know what you mean by loss,' parried the official.

"Finkle explained that he meant the decrease in revenues.

"'The consumer should pay part of it,' said Ballard.

"In answer to other questions, the witness stated that construction work would have to stop for this year at least, that all of the funds derived from the sale of $14,000,000 of bonds in March had been spent and the company would be without money by the middle of August.

"It was brought out that the company has been concentrating on hydro-electric construction since 1910, but under present pressure is adding to steam plant capacity at Long Beach and Redondo.

"Rate increases, if granted, will produce about $3,000,000 additional revenue. The emergency increase is asked for a period of nine months, beginning July 1st of this year."

The budget as drawn up for 1924 called for an expenditure of $26,288,000, but owing to certain financial obstructions, the writer was given to understand that the construction programme for the year had been, to a great extent, postponed until 1925. This was further confirmed by the fact that the number of employés at Big Creek and surrounding camps was very largely reduced during the early months of last year. During the winter of 1923-1924 the precipitation in California was recorded as the lowest known for a number of years (quoting from memory the writer believes the period stated was over 30 years) and the lack of rainfall in the Edison country of the High Sierras very seriously affected the company's output of electricity, so much so that the resident engineer at Big Creek personally addressed a gathering of the employés and instructed all to exercise the greatest possible economy in the use of current in the camp, stating at the time that Huntington Lake held only sufficient water to drive the B.C. turbines for about nine days more unless a fall of snow or rain in the mountains came to their rescue. A small amount of rain did, if the writer remembers correctly, arrive during that critical period, but not sufficient to meet the company's requirements. These dry periods serve to prove the uncertainty of hydro-electric operations in a country of such variable climatic conditions as apply to California, and necessitate the building of stand-by steam plants spread over the supply area to take care of dry seasons.

Referring back to the evident financial restrictions experienced by the company during 1924, presumably these were satisfactorily overcome during the summer, as the prices of the company's shares and bonds quoted on the Los Angeles Stock Exchange on November 7th, 1924, were as follows:—7 per cent. preferred, $105.00; 5 per cent. bonds, 1939, $99.00; 5½ per cent. do., '44, $98.00; 6 per cent. do., '44, $102.38.

The annual report for 1921 issued by the company in March, 1922, contains the following statement of financial earnings, which will give a fair indication of the company's undertaking in its present condition:—

FINANCIAL EARNINGS—1921 AND 1920.

	1921. Dollars.	1920. Dollars.
Gross earnings (including net non-operating revenues) ...	16,645,722.37	14,647,896.32
Operating expenses, taxes (including Federal taxes), insurance and maintenance, but exclusive of depreciation ...	6,935,865.40	6,413,684.52
Net earnings	9,709,856.97	8,234,211.80
Interest and amortization ...	3,940,830.36	3,162,416.42
Balance	5,769,026.61	5,071,795.38
Provision for depreciation ...	2,325,000.00	2,000,000.00
Balance carried to surplus ...	3,444,026.61	3,071,795.38

Net earnings amount to 2.46 times the year's total interest payments, and show an increase of 18 per cent. over the previous year.

Dividends.—Dividends were distributed at the rate of 8 per cent. on the first preferred and common stock and 5 per cent. on the second preferred stock.

	Dollars.
Total dividends paid to date on First Preferred, incl. January 15th, 1922-50 amounting to ...	3,080,000.00
Second Preferred incl. December 15th, 1921-48, amounting to	2,702,387.25
Common Preferred, incl. February 15th, 1922-48, amounting to	10,164,260.12
Total paid	15,946,647.37

In the issue of common stock, the company claims that over 95 per cent. has been sold to residents of California, and that more than 5,000 employés are shareholders in the company. An easy-payment system enables employés to take up shares on a percentage of wages payment, of which, to the writer's knowledge, full advantage is taken by all classes of workers both in the camps and at the company's many centres of operation. Some of the workers with whom the writer came into contact held as much as $5,000 worth or more of stock, in many cases fully paid up.

With regard to the rates charged to the ordinary consumer by the company for energy supplied, these are mainly based on the sliding scale rate. The latest rates fixed by the Railroad Commission of California were reduced all round in 1924, as the following example will show:—

SCHEDULE L.1.

	Rate per kW-hr. Old.	New.
First 50 kW-hr. per meter per month ...	7.92c	6.5c
Next 200 " " " ...	7.04c	5.5c
Next 750 " " " ...	6.16c	5.0c
Next 1,000 " " " ...	5.28c	4.5c
Next 3,000 " " " ...	4.40c	3.5c
Next 5,000 " " " ...	3.96c	3.0c

The increased demand for power in the territory served by the Southern California Edison Company in 1923 was two and a half times greater than for the year 1914.

In October, 1923, the peak load for ten days exceeded 300,000 kilowatts, and the record for the year was made on October 17th, when the load reached 312,500 kilowatts, which was expected to remain the year's record owing to the abnormal demands applying that day, due to exceptional irrigation requirements owing to absence of "fall" rains, an extra heavy railway load, extra large demand by Los Angeles City authorities, and other individual power companies drawing on the Edison supply. This record peak showed an increase of 30 per cent. over the 1922 record peak load.

(To be continued.)

An L.E.E. Dinner.—The sixth annual dinner of No. 4 (Newhaven) Company, London Electrical Engineers, and the 23rd A.A.S.S., R.E., will be held at the "Two Chairmen," Dartmouth Street, S.W.1, on February 21st. Tickets (5s. 6d.) can be obtained from Mr. A. E. Beach, Metal Works, Shawfield Street, S.W.3. The chair will be occupied by Mr. W. J. Rawlings.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Monitor" Safety Valve.

The object of the "Monitor" valve, invented by Mr. C. L. STOKOE, Laburnum Avenue, Wallsend-on-Tyne, is to safeguard the flow of circulating systems in connection with power plant. It is automatic in action, mechanically and electrically simple in design, and also capable of being applied to existing plant without material alteration to pipe line or obstruction of flow. As will be seen from the illustration (fig. 1) there is a balance lever and weight, the lever forming the pointer on a flow indicator. The function of the balance lever is to follow the alteration in the volume of the water flowing through the flap valve, and the weight adopted is the minimum found by tests to overcome the resistance of the flap-spindle bearings and anti-friction gland arrangement and to allow a margin for operating the alarm gear. Attached to the boss of the balance lever is an adjustable tappet which the engineer sets once for all, generally, to operate the alarm gear when the flow through the "Monitor" valve is reduced to what he considers the danger point. There are three electrical terminals, numbered 1, 2, and 3, which carry silver or gold-silver contacts. The action, when the insulated tappet or contactor comes round on failure of the flow, is to tilt up the member No. 1, to make contact with the feeder connection No. 2, and so complete the alarm bell circuit or operate any other gear. At the same moment circuit 3 is broken as the feeder terminal is drawn away. This action makes the indicator lamp go out, or, if desired, the circuit of a no-volt trip

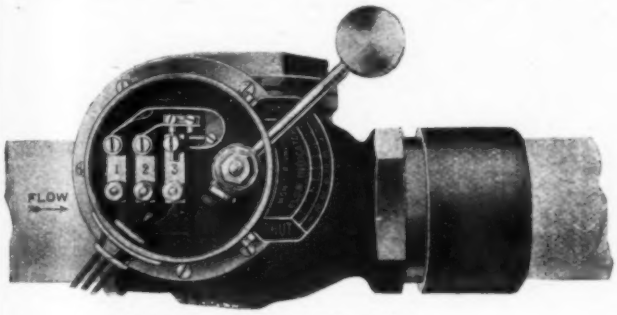


Fig. 1.—The "Monitor" Safety Valve.

coil on the main switch may be broken to stop the motor automatically. The effort required to tilt up the electrical members at the point of alarm is very small, and however suddenly the balance lever drops there will be no shock to the electrical members. Vibration is damped by the upper member carrying a buffer spring shown in the illustration. A special "circular" type is made to safeguard small flows.

The "D.B." Quick-make and Quick-break Switch.

One of the most recent switchgear developments of the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, is the "D.B." quick-make and quick-break switch, with fuses,

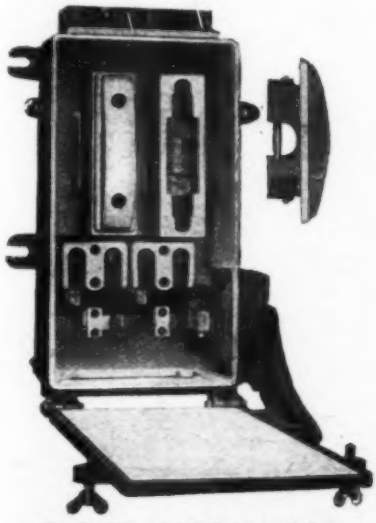


Fig. 2.—The "D.B." Switch and Fuse.

which is illustrated in fig. 2. The switch movement consists of hard-drawn copper blades mounted on a bakelite-insulated steel coupling rod, and ample-sized cable terminals. The rod is fitted with a malleable-iron operating handle, interlocking with the lid of the case, and a strong operating mechanism. The switch blades enter into h.c. copper spring contacts fitted to solid brass terminal blocks, and adequate space is allowed for wiring. The fuses are of the Home Office pattern, provided with well-shrouded handles. The case is of strong fine-grained cast iron. The equipment is produced in two- and three-pole patterns, rated at 60 A at 600 V.

A Small "Botrade Q" Switch.

In our issue of October 24th last we described the "Botrade Q" switch produced by MESSRS. S. BILL & CO., LTD., Queen's Road, Aston, Birmingham. This switch was designed for use on power circuits, but the firm has now introduced a smaller type of switch, similar in all essential respects to the original

Fig. 3.—The small "Botrade Q" Switch.

model, but intended for small lighting circuits. The new design is illustrated in fig. 3. It is rated at 15 A, and is insulated throughout with mica. The switch has a quick-make and quick-break action; the operating handle is interlocked with the cover, and is of unbreakable malleable iron. Ample wiring space is provided, and a special split bush plate facilitates wiring. The switch is made with or without fuses, and is contained in a stoved black enamelled case with gold relief.

A Unit Space Heater.

A compact and convenient form of electric heater applicable to numerous situations has been produced by the CRESSALL MANUFACTURING CO., 40-41, Staniforth Street, Birmingham. This device, termed a "unit space heater" by the company, is illustrated in fig. 4. It has an overall length of 2 ft., and consists of a micanite strip wound with flat

Fig. 4.—A Space-heater Unit.

nichrome ribbon protected and stiffened on both sides by steel plates, and the whole is contained in an outer steel casing, which is rendered rustproof and given an attractive finish by the "Thermozinc" process. The inner holes seen in the illustration are connection eyelets, the outer holes being provided for fixing purposes. The loading is 500 W, and the heater is arranged for three voltage ranges. Among the applications of the heater may be mentioned tramcar heating, the warming of small huts or offices, and in oil stores, drying ovens, &c.

Removing Gases from Valves.

THE HOTPOINT ELECTRIC APPLIANCE CO., LTD., 24, Newman Street; Oxford Street, W.1, has produced a special chamber for removing the gases from valves by a moderate temperature. This consists of a base, into which the valves are fixed, and a chamber which is open at the bottom and lowered by counterweight gear. The chamber is well lagged, and one side consists of a glass panel to permit observation of the valves. The loading is 2 kW, the elements being controlled by a three-heat switch.

Electrical Exports of the United States, 1923.

IN 1922 the United States Government changed and greatly expanded the classification of its foreign trade statistics, and consequently they were no longer on a comparable basis, as regarded certain groups of commodities, with previous years. In particular electrical goods were subdivided in much greater detail. There has recently been issued the annual volume of import and export statistics for 1923 showing the value of United States trade with every country in the world. From this volume figures relating to the exports of the chief classes of electrical goods to some of the principal customer countries of the United States have been extracted and are shown below, the corresponding figures for 1922 being also given, together with notes of increases or decreases.

	1922. $	1923. $	Inc. or dec. $
Generators, d.c., under 500 kW—			
Total	545,000	788,000	+ 243,000
To France	63,000	62,000	– 1,000
,, Canada	80,000	258,000	+ 178,000
,, Mexico	42,000	57,000	+ 15,000
,, Colombia	28,000	26,000	– 2,000
,, Venezuela	25,000	14,000	– 11,000
,, China	37,000	21,000	– 16,000
,, Japan	49,000	38,000	– 11,000
,, Australia	30,000	31,000	+ 1,000
Generators, d.c., 500 kW and over—			
Total	990,000	753,000	– 237,000
To Spain	27,000	31,000	+ 4,000
,, Canada	111,000	39,000	– 72,000
,, Cuba	52,000	128,000	+ 76,000
,, Brazil	29,000	29,000	—
,, Chile	246,000	12,000	– 234,000
,, China	74,000	23,000	– 51,000
,, Japan	383,000	163,000	– 220,000
Generators, a.c., under 2,000 kW—			
Total	197,000	127,000	– 70,000
To Canada	15,000	17,000	+ 2,000
,, Mexico	30,000	4,000	– 26,000
,, Argentina	12,000	8,000	– 4,000
,, Colombia	16,000	14,000	– 2,000
,, China	16,000	—	– 16,000
,, Japan	60,000	12,000	– 48,000
Generators, a.c., 2,000 kW and over—			
Total	1,398,000	1,284,000	– 114,000
To Italy	114,000	—	– 114,000
,, Spain	116,000	19,000	– 97,000
,, Canada	51,000	2,000	– 49,000
,, Mexico	52,000	2,000	– 50,000
,, Cuba	108,000	22,000	– 86,000
,, Brazil	71,000	44,000	– 27,000
,, China	22,000	95,000	+ 73,000
,, Japan	812,000	817,000	+ 5,000
Accessories and parts for generators—			
Total	1,136,000	1,025,000	– 111,000
Self-contained lighting outfits—			
Total	442,000	610,000	+ 168,000
To Spain	16,000	25,000	+ 9,000
,, Great Britain	42,000	61,000	+ 19,000
,, Mexico	28,000	41,000	+ 13,000
,, Argentina	21,000	62,000	+ 41,000
,, Colombia	61,000	14,000	– 47,000
,, India	15,000	2,000	– 13,000
,, Australia	124,000	142,000	+ 18,000
,, British South Africa ...	7,000	38,000	+ 31,000
Power transformers—			
Total	4,159,000	3,195,000	+ 964,000
To Belgium	64,000	—	– 64,000
,, France	592,000	516,000	– 76,000
,, Canada	67,000	45,000	– 22,000
,, Mexico	233,000	104,000	– 129,000
,, Brazil	96,000	188,000	+ 92,000
,, Chile	117,000	112,000	– 5,000
,, India	131,000	62,000	– 69,000
,, China	159,000	112,000	– 47,000
,, Japan	1,673,000	1,490,000	– 183,000
,, Australia	545,000	42,000	– 503,000
,, Spain	45,000	116,000	+ 71,000
Other transformers—			
Total	747,000	760,000	+ 13,000
Rectifiers—			
Total	61,000	(See next item.)	
Switchboards and panels, except telephone—			
Total	2,702,000	1,668,000	–1,034,000
Switches and circuit breakers—			
Total	1,892,000	1,796,000	– 96,000
Fuses and fuse plugs—			
Total	199,000	311,000	+ 112,000
Condensers, double current, and motor generators, dynamotors, synchronous and other converters—			
Total	1,306,000*	999,000†	– 307,000
To France	30,000	318,000	+ 288,000
,, Britain	56,000	41,000	– 15,000
,, Canada	63,000	116,000	+ 53,000
,, Mexico	63,000	30,000	– 33,000
,, Chile	162,000	11,000	– 151,000
,, Uruguay	35,000	5,000	– 30,000
,, India	32,000	45,000	+ 13,000
,, Japan	297,000	171,000	– 126,000
,, Australia	410,000	33,000	– 377,000
Watt-hour and other meters—			
Total	564,000	519,000	– 45,000
To Canada	70,000	94,000	+ 24,000
,, Mexico	93,000	59,000	– 34,000
,, Cuba	52,000	71,000	+ 19,000
,, Brazil	52,000	50,000	– 2,000
,, China	48,000	48,000	—
,, Japan	55,000	56,000	+ 1,000
Volt, watt-, ampere-, and other meters and apparatus—			
Total	876,000	1,027,000	+ 151,000
Lightning arresters, choke coils, &c.—			
Total	678,000	616,000	– 62,000
Motors, under 1 h.p.—			
Total	772,000	1,728,000	+ 956,000
To Holland	20,000	15,000	– 5,000
,, Spain	30,000	64,000	+ 34,000
,, Great Britain	218,000	647,000	+ 429,000
,, Canada	240,000	459,000	+ 219,000
,, Mexico	21,000	21,000	—
,, Argentina	19,000	25,000	+ 6,000
,, Japan	70,000	98,000	+ 28,000
,, Australia	46,000	84,000	+ 38,000
Stationary motors, 1 to 200 h.p.—			
Total	2,037,000	3,088,000	+1,051,000
To Spain	58,000	106,000	+ 48,000
,, Great Britain	97,000	132,000	+ 35,000
,, Canada	472,000	562,000	+ 90,000
,, Mexico	153,000	155,000	+ 2,000
,, Cuba	97,000	121,000	+ 24,000
,, Brazil	66,000	65,000	– 1,000
,, Chile	67,000	46,000	– 21,000
,, China	125,000	92,000	– 33,000
,, Japan	316,000	454,000	+ 138,000
,, Australia	164,000	406,000	+ 242,000
,, British South Africa ...	50,000	157,000	+ 107,000
Railway motors—			
Total	480,000	660,000	+ 186,000
To Canada	79,000	12,000	– 67,000
,, Brazil	43,000	66,000	+ 23,000
,, Chile	6,000	136,000	+ 130,000
,, Japan	273,000	249,000	– 24,000
Motors, over 200 h.p.—			
Total	666,000	813,000	+ 147,000
Starting and controlling equipment—			
Total	920,000	1,752,000	+ 832,000
Accessories and parts for motors—			
Total	1,138,000	1,659,000	+ 521,000
Railway signals, switches, and attachments—			
Total	685,000	734,000	+ 49,000
To Canada	76,000	213,000	+ 137,000
,, Japan	450,000	185,000	– 265,000
Insulating material—			
Total	889,000	1,436,000	+ 547,000
To France	43,000	60,000	+ 17,000
,, Great Britain	148,000	345,000	+ 197,000
,, Canada	225,000	357,000	+ 132,000
,, Japan	145,000	241,000	+ 96,000
,, Australia	59,000	56,000	– 3,000
Fans—			
Total	816,000	859,000	+ 43,000
To Canada	120,000	60,000	– 60,000
,, Argentina	34,000	66,000	+ 32,000
,, China	108,000	169,000	+ 61,000
,, British India	154,000	136,000	– 18,000
,, Australia	62,000	60,000	– 2,000
,, Cuba	9,000	21,000	+ 12,000
,, Mexico	40,000	47,000	+ 7,000

* Not including rectifiers in 1922.
† Including rectifiers in 1923.

	1922. $	1923. $	Inc. or dec. $
Heating and cooking apparatus—			
Total	597,000	984,000	+ 387,000
To Norway	5,000	6,000	+ 1,000
„ Great Britain	76,000	128,000	+ 52,000
„ Canada	128,000	224,000	+ 96,000
„ Japan	62,000	59,000	− 3,000
„ Argentina	39,000	44,000	+ 5,000
„ Australia	70,000	199,000	+ 129,000
„ Mexico	43,000	46,000	+ 3,000
„ Brazil	12,000	10,000	− 2,000
Motor-driven household devices—			
Total	642,000	866,000	+ 224,000
To Holland	103,000	79,000	− 24,000
„ Britain	114,000	265,000	+ 151,000
„ Canada	200,000	144,000	− 56,000
„ Japan	43,000	15,000	− 28,000
Industrial electric furnaces and ovens—			
Total	238,000	214,000	− 24,000
Metal filament lamps—			
Total	1,225,000	1,131,000	− 94,000
To Italy	—	4,000	+ 4,000
„ Canada	91,000	37,000	− 54,000
„ Peru	20,000	21,000	+ 1,000
„ Mexico	222,000	255,000	+ 33,000
„ Cuba	140,000	185,000	+ 45,000
„ Argentina	160,000	95,000	− 65,000
„ Brazil	45,000	22,000	− 23,000
„ Australia	98,000	101,000	+ 3,000
„ British South Africa ...	70,000	49,000	− 21,000
Magnetos, spark plugs, &c.—			
Total	1,093,000	1,695,000	+ 602,000
To Italy	5,000	26,000	+ 21,000
„ Great Britain	57,000	50,000	− 7,000
„ Canada	430,000	616,000	+ 186,000
„ Argentina	79,000	90,000	+ 11,000
„ India	13,000	12,000	− 1,000
„ Japan	58,000	117,000	+ 59,000
„ Australia	46,000	93,000	+ 47,000
„ New Zealand	9,000	24,000	+ 15,000
„ British South Africa ...	12,000	12,000	—
„ Mexico	32,000	29,000	− 3,000
Insulated wire and cable, iron and steel—			
Total	378,000	687,000	+ 309,000
To Canada	31,000	17,000	− 14,000
„ Mexico	43,000	95,000	+ 52,000
„ Cuba	57,000	122,000	+ 65,000
„ Brazil	59,000	18,000	− 41,000
„ Japan	53,000	95,000	+ 42,000
Insulated wire and cable, copper—			
Total	1,982,000	3,140,000	+1,158,000
To Britain	88,000	274,000	+ 186,000
„ Canada	250,000	404,000	+ 154,000
„ Mexico	239,000	414,000	+ 175,000
„ Cuba	194,000	502,000	+ 308,000
„ Brazil	277,000	306,000	+ 29,000
„ Chile	64,000	121,000	+ 57,000
„ China	94,000	59,000	− 35,000
„ Japan	118,000	168,000	+ 50,000
„ Philippine Islands	60,000	72,000	+ 12,000
„ Australia	55,000	34,000	− 21,000
Batteries, primary—			
Total	1,047,000	1,273,000	+ 226,000
To Norway	18,000	15,000	− 3,000
„ Great Britain	11,000	24,000	+ 13,000
„ Canada	25,000	18,000	− 7,000
„ Argentina	232,000	310,000	+ 78,000
„ Chile	15,000	22,000	+ 7,000
„ China	15,000	29,000	+ 14,000
„ Australia	77,000	71,000	− 6,000
„ New Zealand	58,000	87,000	+ 29,000
„ British India	25,000	42,000	+ 17,000
„ Brazil	50,000	27,000	− 23,000
„ Mexico	131,000	158,000	+ 27,000
„ Spain	32,000	13,000	− 19,000
Batteries, primary, wet—			
Total	36,000	*	—
Batteries, storage—			
Total	1,474,000	2,344,000	+ 870,000
To Denmark	69,000	118,000	+ 49,000
„ France	78,000	59,000	− 19,000
„ Britain	143,000	202,000	+ 59,000
„ Canada	153,000	220,000	+ 67,000
„ Mexico	63,000	111,000	+ 48,000
„ Argentina	117,000	255,000	+ 138,000
„ Brazil	56,000	92,000	+ 36,000
„ India	69,000	57,000	− 12,000
„ Australia	124,000	235,000	+ 111,000
Metal conduit, outlet and switch boxes—			
Total	295,000	478,000	+ 183,000
Sundry wiring supplies and fixtures—			
Total	1,342,000	1,891,000	+ 549,000
Telegraph apparatus—			
Total	1,342,000	1,891,000	+ 549,000
To Great Britain	60,000	66,000	+ 6,000
„ Cuba	4,000	20,000	+ 16,000
„ Canada	88,000	87,000	− 1,000
„ Japan	23,000	66,000	+ 43,000
„ Argentina	5,000	362,000	+ 357,000
Radio apparatus—			
Total	2,898,000	3,448,000	+ 550,000
To Poland	572,000	11,000	− 561,000
„ Great Britain	320,000	200,000	− 120,000
„ Canada	805,000	796,000	− 9,000
„ Argentina	651,000	647,000	− 4,000
„ Cuba	120,000	212,000	+ 92,000
„ Mexico	89,000	281,000	+ 192,000
„ Sweden	2,000	459,000	+ 457,000
„ Australia	25,000	210,000	+ 185,000
Telephones, magneto—			
Total	*	196,000	—
To Great Britain	*	11,000	—
„ Canada	*	44,000	—
„ Cuba	*	42,000	—
„ Colombia	*	14,000	—
„ Australia	*	18,000	—
Telephones, other—			
Total	*	406,000	—
To Canada	*	85,000	—
„ Mexico	*	10,000	—
„ Cuba	*	34,000	—
„ Brazil	*	76,000	—
„ Australia	*	71,000	—
„ New Zealand	*	47,000	—
Magneto switchboards—			
Total	*	119,000	—
Other telephone switchboards—			
Total	*	403,000	—
Locomotives, electric railway—			
Total	854,000	3,037,000	+2,183,000
To France	—	224,000	+ 224,000
„ Spain	—	484,000	+ 484,000
„ Chile	548,000	2,092,000	+1,544,000
„ Japan	291,000	118,000	− 173,000
Locomotives, electric, mining and industrial—			
Total	225,000	277,000	+ 52,000
To Chile	14,000	34,000	+ 20,000
„ Japan	64,000	147,000	+ 83,000
„ Mexico	30,000	47,000	+ 17,000
„ Australia	30,000	—	− 30,000
„ British South Africa ...	18,000	22,000	+ 4,000
Total of electrical machinery and apparatus	53,147,000	59,927,000	+6,780,000

* In 1923 included in " Batteries, primary," above.

* Not shown separately.

Educational.—FARADAY HOUSE.—*Entrance Scholarship Examinations.*—The annual examinations for a Faraday scholarship of fifty guineas per annum tenable for two years in College and one year in manufacturing works, and for a Maxwell scholarship of fifty guineas per annum tenable for one year in College and one year in works, will be held at Faraday House, on April 7th, 8th, and 9th, 1925. Exhibitions may also be awarded to candidates who acquit themselves creditably in the above examinations, but do not obtain the necessary number of marks to qualify for the Faraday or Maxwell scholarships. Further particulars may be obtained from the Secretary, Faraday House, 62-70, Southampton Row, London, W.C.1.

Hotel Signalling System.—More than twelve years' work and nearly a quarter of a million pounds have been expended by the London, Midland and Scottish Railway in renovating its Birmingham hotel (the Queen's), which will be finished within the next few weeks. Among innovations is one to minimise noise, an ingenious system of light-signals in place of bells. The touch of a " bell-button" by the bedside switches on a series of signal lamps—outside the guest's door, in the adjoining corridor, in the attendant's pantry, in the manager's office, and on an indicator board in the main hall. As the lamps can be extinguished only at the room door itself, the management is able to supervise and ensure prompt service. By means of a " maid finder," another electrical device embodied in the system, the silent signal also reaches a servant who may at that moment be working in another bedroom. This noiseless scheme of signalling has been extended to other parts of the hotel to apply to the waiting staff, porters, lift men, and reception clerks.

The London County Council Tramways.

Report on the Financial Position.

THE Finance and Highways Committees of the London County Council have prepared a joint report upon the financial position of the Council's tramways, containing a detailed consideration of possible means of alleviating the heavy annual burden which the revenue is unable to sustain at present.

At the outset it is stated that the estimates of the current year's results have to be revised on account of the increased charges resulting from the wage increases granted to the employés last year. The surplus on working is expected to be £194,605. Against this will be charged £355,087 interest on debt, and £418,936 repayment of debt and, after a small adjustment, the net deficit is put at £576,798. Apart from the increased wages mentioned above, it is stated that there has been a diminution in traffic, causing a loss of revenue. Towards the estimated deficit there is £40,000 in the reserve fund, and about £180,000 is being raised by a special county rate, leaving a balance of about £360,000 unprovided for.

Eight possible sources of relief have been explored by the Committees and their conclusions are given *seriatim*.

In the first place the increasing of fares was considered. In this matter it was thought that although the reduction of fares had resulted in a fall in revenue, if the reductions had not been made the decline would have been more serious. Moreover, a better proportion of revenue is being obtained from the fares which have recently been reduced than from the higher fares. The Committees are thus forced to the conclusion that no solution lies in this direction.

The next consideration was the reduction of working expenses. The Council recently adopted a report by a Special Committee which covered the whole of the Council's organisation, and it is considered that the effect of putting this Committee's proposals into force, combined with certain other improvements in the tramway department, will be substantial relief. The amount of this, however, precludes it from being a total remedy.

The upkeep of roadways in connection with the tramways costs the Council about £250,000 a year. The liability for this work was imposed upon tramway undertakings in the days of horse-drawn cars and still persists. Legislation would be necessary before relief could be obtained under this head. It is also to be noted that as the Council is liable for the maintenance of the roadways in question in its capacity as a tramway authority, and not as a highway authority, the Ministry of Transport has refused to sanction grants from the Road Fund towards the expenditure. The subject is again to be brought before the National Joint Industrial Council for the Tramways Industry at the first suitable opportunity. Meanwhile, in connection with this question, the Metropolitan Municipal Tramways Council proposes to place before the Minister of Transport certain facts relating to the tramways of the Metropolitan area, with the hope of obtaining grants from the Road Fund for the undertakings in the area. The Council, says the report, cannot hope for immediate relief in this matter, but it will not be lost sight of.

The rating of tracks is next examined, but as any relief obtained in this direction would merely be transferred to the local rates, the Committees do not suggest that any action should be taken at the present time.

It is the established policy of the Council to charge against the tramways an appropriate part of the cost of street improvements effected on tramway routes. The principal argument against this is that other transport undertakings derive as much benefit from these improvements as the tramways, but escape the charge—to the detriment of the tramways. The Council may exercise its discretion in this matter so far as future street widenings are concerned, but it is doubtful whether allocations of capital cost which have already been made could legally be removed from the tramway undertaking. The amount involved, however, is relatively small—about £30,000 per annum.

For three years, 1919-20, 1920-21 and 1921-22, half the cost of renewals of track was charged to capital account. Although this temporarily relieved the revenue accounts of the three years to the extent of £484,064, the ultimate result will be an extra charge on account of interest of £323,095. Thus this process is costly and should not be resumed.

It is hoped that the work of the London Traffic Advisory Committee will lead to the elimination of unnecessary competition. In the opinion of the Committees this is the line along which relief can be most legitimately and reasonably afforded.

Having considered all the above expedients the Committees come to the last one, which is considered to be the only method by which the necessary relief can be obtained at once. The greater part of the moneys raised for the undertaking consists of 25-year loans. This is considered to be a conservative estimate of the life of the assets which the loans represent and the Committees are satisfied that a longer period of repayment could be justified. Calculations show that the amount which has been provided for repayment is as much as £1,250,000 in excess of the amount strictly necessary, based on later estimates of the life of the assets.

The Committees accordingly recommend that further repayment of the 25-year debt be deferred for a period of (say) three years, and that the period of repayment be extended accordingly. It will be necessary to seek the sanction of H.M. Treasury to this arrangement.

The charge in the current year for the repayment of the tramway debt is £418,936, including £302,650 as provision for repayment of the 25-year debt. Thus the relief which would be obtained in each of the next three years would be about £300,000. For the Council's information it is stated that the total debt incurred up to March 31st, 1924, was £16,588,862. Of this £7,740,279 (46½ per cent.) has been repaid.

At the meeting of the L.C.C. on February 3rd, Mr. J. M. Gatti, Chairman of the Finance Committee, presented the report. He said that the undertaking had gone through a period of great stress—hence the deficit, which was not a deficit on working. There was a certain amount of opposition to the proposals, but they were eventually adopted.

The Electrical Wholesalers' Federation.

Annual Dinner.

THE annual dinner of the Federation was held at the Trocadero Restaurant on February 5th, under the presidency of Mr. J. Gledson (president). After an excellently served repast and the loyal toast, Mr. A. ALBRECHT proposed the toast "Kindred Associations." Dealing specifically with the manufacturing associations, Mr. Albrecht said that these bodies had at least one factor in common with the E.W.F.—their work was largely educational. Moreover, they were coming to realise that sections were not so important as the electrical industry as a whole; real prosperity could only come from a prosperous industry. Thus the ruthless competition which had formerly prevailed was giving place to helpful co-operation. The evidence before the Food Commission had shown that the middleman was most essential to the scheme of affairs; it had also shown that middlemen made no profits! There was an urgent need for a reduction in selling costs, and that was one of the Association's principal cares. He believed that the electrical industry was the one with the brightest future and the largest financial reward. He was glad to note the presence of Mr. Dunlop, of the B.E.A.M.A.; perhaps he would say something to raise the wholesalers' hopes. In conclusion, he referred again to the necessity for a joint Association of the industry to which questions affecting different sections could be referred.

Mr. A. G. BEAVER, in supporting the toast, with special reference to the publicity and distribution sides, agreed that the wholesaler made no profit—but he looked very well on it! The work done by the British Electrical Development Association was invaluable; there was no growth without advertising. The Electrical Contractors' Association was in direct touch with the public. He said that the trading policy which had just been put into words by the E.W.F. was in many respects a parallel of the E.C.A.'s trading policy. The two Associations could therefore go a long way together, and no difference would be insurmountable. Mr. Beauchamp, of the E.D.A., was an organiser of no mean ability, and the most efficient subscription-raiser in the industry. Nevertheless, the E.W.F. would like to know how the money was to be spent before it increased its contributions. In the enthusiasm engendered by the E.D.A. propaganda there was a danger that fair trading would be lost sight of. Already there was a great deal of unfair competition in supplies and wiring by municipal supply undertakings—many of them gave away kettles to encourage the use of cookers. This matter required most careful consideration.

Mr. D. N. DUNLOP, replying on behalf of the B.E.A.M.A., the C.M.A., and the E.L.M.A., said that mention had been made of profits. There was nothing to be ashamed of in profits; in fact, the B.E.A.M.A. would like more—it was not making enough. There was undoubtedly a bright future for the industry. Manufacturers never knew when a discovery would be made which would alter the whole of industry and civilisation from top to bottom. There was a necessity for more and more research—and there was a need for profits to enable research to be pursued. Referring to the recent speeches by chairmen of banks, Mr. Dunlop said that the policy of this country had too long been controlled by the middleman and the banker; it was time that the manufacturer had a larger share in affairs. He was glad to see that the E.W.F. gave preference to British goods, while, correctly enough, reserving its freedom of choice. There was never a time when the electrical manufacturing industry had been better able to meet the future than the present time. In conclusion, Mr. Dunlop said that if there was to be a joint Association of the industry, Mr. Beauchamp was the man to call them together.

Mr. R. FERGUSON (National Association of Radio Manufacturers and Traders) replied on behalf of the radio industry. He said that his Association, though a young one, had been

as successful as the British Broadcasting Co., with which it was intimately connected. They were endeavouring to secure fair trading, but a great deal of unintelligent criticism had been levelled against them. Referring to endeavours to change the basis of broadcasting in this country, the speaker said that the present system was the best for all concerned. The B.B.C. could carry out the business far better than any Government department. He concluded by making a statement regarding the attitude of the theatrical profession towards broadcasting.

Mr. W. RIGGS (President, Electrical Contractors' Association) replied on behalf of the distributing branches of the industry. He welcomed the E.W.F. trading policy, which, however, was rather overdue, but he thought that a number of matters would have to be discussed by their two Associations. Agreement between them was necessary and would be beneficial. He said that the supply authorities were not only in competition with the wholesalers, but with the contractors too. There were at present six Bills before Parliament in which suppliers sought trading powers. The E.C.A. was opposing these, and he thought that the E.W.F. should do its share in this direction.

Mr. J. W. BEAUCHAMP (E.D.A.), who also replied, said that he rose to defend the municipal supply undertakings. The question raised by previous speakers was an extraordinarily difficult one. No undertaking was giving away kettles; they hired kettles as a necessary adjunct to electric cookers. The municipal undertakers could all hire out apparatus by arrangement with electrical contractors, and hiring was absolutely necessary. There were few undertakings which possessed trading powers and exercised them, and these would be glad to relinquish them if the contractors would do their business. The E.D.A. was out to secure electricity for everybody, and the contractors would have to co-operate with the suppliers of energy. Mr. Dunlop's suggestion of a federation of electrical associations was a good one, but when he offered him (the speaker) the job of calling them together he was sure that there was a catch in it somewhere. He was already hard-pressed, but with more generous assistance, the E.D.A. could solve a great many problems. He asked the E.W.F. to take a broader view of his Association's work. It was hoped that the suppliers and manufacturers were going to increase their subscriptions, and the E.W.F. should not want to be left in the cold. The public had to be educated, and hitherto the traders had done little in this direction.

Mr. J. Y. FLETCHER, in proposing the "Electrical Wholesalers' Federation," said that his Association (E.L.M.A.) always tried to do the "square thing," and it was meeting with success. The E.W.F. was by far the largest distributor of the lamps produced by members of the E.L.M.A. He appealed for a better standard of lighting in this country, and made mention of his Association's educational efforts to secure this. He also asked for the consideration of British goods first to reduce the appalling volume of unemployment.

Mr. J. GLEDSON responded to the toast in a brief speech.

Other toasts were "The Press," proposed by Mr. G. DONOVAN, and replied to by Mr. E. A. GATEHOUSE (ELECTRICAL REVIEW), and "The President," proposed by Mr. J. M. SIM.

Messrs. Charles True, Leslie Weston, and Frederick Arthur, and Miss Gladys Trevor provided a musical entertainment between the toasts. The arrangements were admirably looked after by Mr. "Bobbie" Smith.

Tramways and Motor Omnibuses.

By G. MARSHALL HARRISS.

(*Abstract of Paper read before the* INSTITUTION OF CIVIL ENGINEERS OF IRELAND.)

DURING the proceedings of a Joint Committee of the *Oireachtas* counsel suggested to a witness that there was a tendency, not only in this country, but in England, to substitute petrol-driven for electrically-driven traffic. The witness, while agreeing as to the boom which occurred about 1896 and that extensions had fallen off very much, pointed out that tramways were carrying more people now than ever and did not agree that tramways could be driven off the streets of London. The law from the outset put a strangle-hold on tramway extensions, because it imposed upon the industry the responsibility for the construction and maintenance of the roadway between the rails and 18 in. outside, with all that that means. In addition tramway tracks are rated, and in Dublin there is a heavy way-leave charged per route mile of street used, with decreasing charges in the townships and outlying districts. No other vehicle running on the highways is asked to bear, or, indeed, could bear, anything approaching this heavy burden, and electric tramways not only bear these charges, but, in addition, while providing the cheapest transport, are paying a dividend on the money invested, and they are prosperous. This, it is believed, is fairly conclusive proof of the superiority of tramways for transport on the highways through cities.

There is invested in the tramway industry in Great Britain and Ireland over 72 million pounds sterling, yielding a revenue of over 28 million pounds per annum. The route length of track in the year 1919 was 2,560 miles, and in the year 1924 2,624 miles, and the passengers carried over 4,150 millions. This large industry is not without its black sheep. Two or three small systems have ceased to operate and several are considering either whole or partial conversion to the railless electric system, but none of them were ever of very much importance. Assuming, however, that those routes now under consideration for conversion were added to those abandoned, which is very unlikely to happen, it would mean that 1.8 per cent. of the capital invested had gone wrong, and some 1.5 per cent. of the present revenue lost, affecting 1.4 per cent. of the passengers carried; there are few industries made up of so many separate undertakings that, after some twenty years running, have done better. There are perhaps no systems which can claim that every route originally installed is a paying one, and the astonishing feature is that so few non-paying routes have been abandoned in view of the heavy wages increases on top of the charges for road maintenance, while against this we have recent additions made to the tramways in Birmingham, Newcastle, Portsmouth, Southampton and other towns, while extension schemes are proposed in London, Manchester, Liverpool, Nottingham and elsewhere.

Possibly influenced by such cases as mentioned, and by the *Daily Mail* articles, some apprehension may have arisen in the mind of the man in the street as to the future of tramway undertakings. There is no such apprehension in the minds of those directly interested in the business.

Apart, however, from finance, there has arisen a controversy on the subject of traffic congestion and tramways. The matter is important and demands a good deal of attention.

The relative merits of various forms of traction has also been closely examined by the Manchester Corporation, and the conclusion is that at the present time no other form of transport is available that can supersede the tramcar on its essential merits. 'Buses, undoubtedly, have their use as feeders to the tramways for outside areas, but there is no vehicle yet constructed that is able to move passengers *en masse* with the same freedom and absence of congestion as characterises the tramcar. With our variable climate, a tramcar carrying seventy people under cover is surely to be preferred to a 'bus which takes practically the same room on the street, but the capacity of which is, in wet weather, limited to the number of people it can carry inside. It is reckoned in Glasgow that for every tramcar displaced, it would be necessary to put three 'buses in operation, each unit of which would occupy the same room as a tramcar in our congested central area streets.

The matter is one which all tramway authorities are bound to face at the present time, especially with the increasing interest which motor 'buses now represent, but to any unprejudiced person, it must be obvious that the one vehicle which stands out pre-eminently as suitable for the mass transportation of passengers is the tramcar.

The road space occupied by one of the Dublin standard double-track double-deck tramcars seating 76 passengers under cover is 34 ft. by 7 ft. 2 in., or 27 yards super. To carry the same number of people in 'buses two vehicles, each holding 38 passengers, would be required; the space they would occupy would be 67 super yards. The same number of men on the march would cover 92 super yards, and if on bicycles, 195 yards; while on motor bicycles with side cars the space required would be 507 super yards; or if in taxis, nineteen vehicles would be necessary, occupying 507 yards. A vehicle confined to a fixed track leaves open on its near side a space that, with perfect safety, is used both by vehicles running at a higher speed and wishing to pass on that side, and by vehicles coming in the opposite direction, provided passengers going to or from a tramcar are not endangered, whereas with a 'bus, or any other steerable vehicle, this space becomes so unsafe that it is as effectively barred as if not there at all.

The problem as to the most suitable road for transport into the cities from suburban districts and for development beyond, has been solved in Birmingham and some Continental places; two one-way roads are provided, separated by a double line of rails reserved for rapid transport, with crossing places for ordinary traffic at intervals as desired, which also serve for loading and unloading places. In this way the cost of track construction and after maintenance is kept to a reasonable figure, while the tractive effect necessary is reduced and smooth running secured.

By such methods the aims of those responsible for tramway undertakings become more nearly within reach, and the solution of this problem becomes easier with trolley and motor 'buses working as auxiliaries to tramways; the problem will not be solved without tramways.

Gas and Electricity.—Offering a welcome to members of the West Yorkshire Section of the British Commercial Gas Salesmen's Circle, on January 31st, Mr. R. Stirk, chairman of the Halifax Gas Committee, said he was also a member of the Electricity Committee of the Corporation, and he was ready to acknowledge that both gas and electricity had a big field before them. His own house was lighted by electricity and he recognised that there were certain purposes for which electricity was the more suitable. On the other hand, there were many purposes for which gas was unquestionably better. He was convinced that there need be no enmity between the two professions, but a healthy competition which would prove beneficial to both.

Radio Telephony at Sea.

Experiments at Southampton.

A RADIO-TELEPHONE service between ships and the shore which may be linked up with the General Post Office land telephone lines is undergoing experiment at Southampton and has reached such a stage that a commercial service could be undertaken if suitable wavelengths could be allotted free from mutual interference between the service and existing broadcasting and other commercial radio stations. The experiments are being conducted by the Marconi Co., in conjunction with the General Post Office and the Southern Railway Co., whose cross-Channel steamer *Princess Ena* is being used for the purpose. A " duplex " radio telephone set has been specially designed by the Marconi Co. for the experiments, and the technical problems connected with such a system are claimed to have been solved. Further experiment is still necessary, however, in order to fit in a service of this nature amongst existing radio services without mutual interference. By the courtesy of the G.P.O., the land station for the experiments has been established at the Sectional Engineers' Office at Millbrook, Southampton. Under good conditions, perfectly good simplex telephone communication has been obtained between the *Princess Ena* at sea and Southampton up to a distance of about 200 miles; and reliable duplex communication can be assured up to 100 miles, except at moments of exceptionally strong jamming. Satisfactory commercial communication from city offices to the ship over long land lines — such as from offices in London by Post Office telephone lines to Southampton, and thence by radio to the ship—have been obtained when the *Princess Ena* has been 50 miles from the shore. A problem still awaiting solution is the elimination of interference from spark telegraph stations. It is easier to eliminate jamming from a c.w. transmitter installed on the same table, alongside the receiver of the duplex telephone set on the ship than to eliminate spark jamming from other ships dozens of miles away. When this difficulty is overcome, duplex radio-telephone service will be of great value to shipping companies. Messages concerning the docking of vessels can be handled with great rapidity, and it is possible that, if the Post Office agrees to such a service, additional facilities will be placed at the disposal of the travelling public. Fig. 1 shows the Marconi " Duplex " transmitter on the *Princess Ena*, fig. 2 illustrating the receiver, while fig. 3 is a general view of the shore apparatus, showing the arrangement for linking with the land lines on the left.

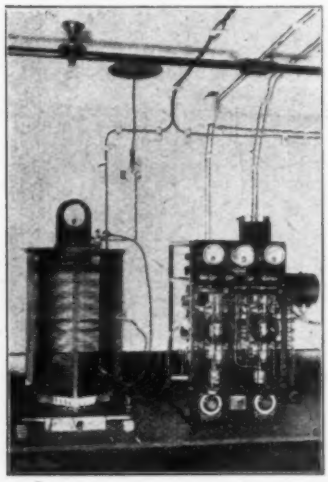


Fig. 1.—Marconi 400-watt " Duplex " Transmitter on the " Princess Ena."

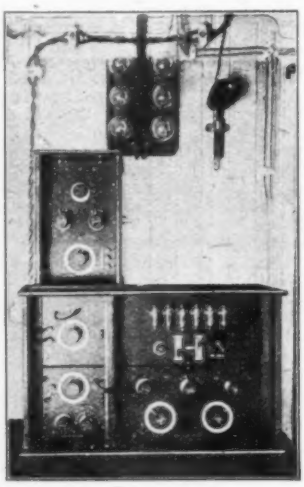


Fig. 2.—Radio-telephone Receiver on board the ship.

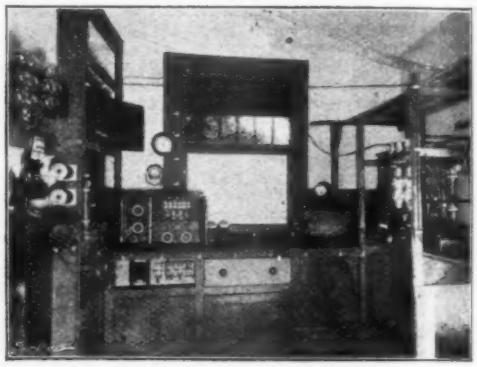


Fig. 3.—General View of the Set on shore, showing the land-line linking apparatus on the left.

Outdoor Pole-Type Trifurcating Box.

A · J. and P. Design.

OF a novel design, the new outdoor pole-type trifurcating box, fig. 1, evolved by Messrs. Johnson & Phillips, Ltd., should prove particularly serviceable under severe conditions, such as in an atmosphere likely to produce corrosive effects. It is designed for pole-mounting and for connecting three-core underground cables to overhead lines, and is suitable for any size of cable up to .3 sq. in. section, 3-core, with any type of armour or covering and at pressures up to 12,000 V.

The brown glazed porcelains are provided with two petticoats and are cemented into metal rings, which are screwed to the under side of the box. The top of the box is so shaped that under heavy showers of rain a minimum amount of water runs on to the insulators, the bulk of it being so conducted by the shape of the covering that it runs between the insulators.

Tests carried out by the designers show that when the porcelains are dry they do not flash over until a pressure of from 74,000 to 79,000 volts is applied, and fig. 2 illustrates the arc flashing over the porcelain at a pressure of 76,000 volts between the case and the live terminal.

The B.E.S. specification No. 137 requires that an outdoor porcelain of the pin type, for use on an overhead line at 10,000 volts, should not jump over under 62,000 volts when dry, so that this design more than fulfils this requirement. Under the rain test, the B.E.S. specification also requires that a pin-type insulator, subjected to rain at a temperature of about 15 deg. C., and equivalent to 1 in. in five minutes directed downwards at an angle of 45 deg. to the vertical during the test, shall not spark over under 39,000 volts. The box insulators withstand this test, which is much more severe than in the case of the ordinary pin type insulator used on an overhead line, since

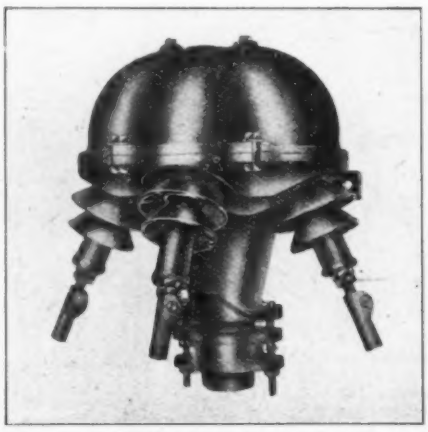


Fig. 1.—Johnson & Phillips Pole-type Trifurcating Box.

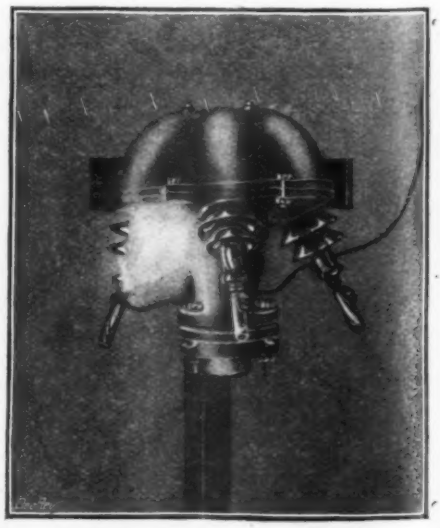


Fig. 2.—A flash-over at 76,000 volts.

the top of the box acts as a water-shed, and directs more water on to the insulators than would be the case if they were exposed in the same way as overhead line insulators.

The insulators are intentionally not shielded from the rain, as the latter performs the useful function of washing the insulators, thus diminishing the possibilities of the accumulation of conductive coatings when in fume or salt-laden atmospheres.

Legal.

British Thomson-Houston Co., Ltd., v. British Insulated and Helsby Cables, Ltd., and v. Charlesworth, Peebles and Co.

As briefly reported in our last issue, Lords Haldane, Dunedin, Shaw, Buckmaster and Blanesburgh, delivered their considered judgments in the House of Lords on February 3rd in these two cases, each of which raised the same point, *viz.*, whether there had been infringement of the British Thomson-Houston patent of 1909 for an invention of improvements relating to the treatment of tungsten to facilitate working, principally for the production of filaments for electric lamps. While the Scottish Courts held the patent to be valid and infringed, the English Courts found it to be invalid, the consequence being that Charlesworth, Peebles & Co. appealed against the former judgment, and the British Thomson-Houston Co., Ltd., against the latter decision. The two appeals were heard at the same time last December, the arguments extending to several days (*vide* ELEC. REV., December 5th, 12th, 19th and 26th).

Lord HALDANE said it was difficult to assent to the proposition that in point of principle there had really been stated any new invention that in itself could be by our law the subject matter of a patent. In the patent of 1906 the claim was for a method of working tungsten which consisted in subjecting it in a coherent form to the action of heat while it was being operated on. The specification told the public that when tungsten was thus heated it underwent remarkable molecular changes, such that it became so ductile that it might be easily worked when hot. This was also stated in the patent of 1909. In neither patent was any explanation offered of the nature of these molecular changes; they were merely descriptions of the property of ductility. What was really claimed as new in that of 1909 was ductility at ordinary temperature. But in this later patent they were told that, "When the tungsten bodies have been sufficiently worked while hot to assume this ductile conation at ordinary temperatures, further working may nevertheless be carried out while hot, if so desired, since, while it is then possible to work the bodies cold, it may be found easier and more beneficial to continue working them while hot." Reading the two patents together, it did not appear to his Lordship that tungsten made ductile when hot under that of 1906 was materially different from tungsten that was ductile when it had cooled down after treatment by the method of 1909. The metal worker of ordinary skill appeared capable of getting the same product by either method of working. In this connection it was significant to notice further that a valuable commercial product did not appear to have emerged before 1911 or 1912, another indication that such a product required development in the metal worker's hands, even in the case of the 1909 patent. Until the end of 1911 neither the process of 1906 nor that of 1909 appeared to have supplied the demand for tungsten filaments. They were as late as that date still manufactured mainly out of squirted paste prepared by the Just and Hanaman process. There was no doubt in his Lordship's mind that the improvement in methods of production made under the process which was developed from the old way of treating tungsten in producing filaments, first under the patent of 1906 and later under that of 1909, was a very great improvement. It had slowly, but surely, resulted in a great commercial success. That fact afforded the presumption of a novelty in discovery. But it did not follow by any means conclusively that the improvement lay in a discovery based on a new invention. It might have consisted in a mere improvement, of however great an order, in the mode of treatment of the metal, due to what was no more than increased skill in the mode of preparation. The 1906 patent showed how tungsten could be rendered ductile by heating during hammering, rolling and drawing processes. When it was thus made ductile when hot it did not appear to necessitate any new invention of a scientific order to enable one to ascertain whether if he let it cool he would still find it ductile. An advance in his everyday experience would in itself lead him to this conclusion. His Lordship believed that the method of progressive treatment by steps was probably very valuable, but this treatment was equally applicable in the case of heated tungsten. Reading the patents together, he thought that the claim was one really for tungsten ductile when cold, and not for new steps by which the metal was hammered, rolled, or drawn in a graduated fashion. That fashion of treatment was an improvement which in itself could hardly be said to amount to a patentable invention, for it embodied a mode of treatment which was already familiar in dealing with other metals. For example, as Lord Justice Sargant pointed out in his judgment in the English case, referring to a comparative table that had been put in:—"There is no extraordinary difference or variation between the steps in the case of tungsten, on the one hand, and copper standard wire gauge or platinum iridium on the other hand—nothing sufficient to amount to a difference in kind or even to a very marked difference in degree."

In the light of the evidence Lord HALDANE was unable to believe that repeated mechanical working was, by itself, a new discovery or a patentable invention under the patent of 1909. He was of opinion that the English appeal should be dismissed with costs and the Scottish appeal be allowed with costs.

Lord DUNEDIN (who was in a minority in the Duram case, which was before the House of Lords a few years ago, being prepared then to grant the injunction asked for by the British Thomson-Houston Co. in respect of its 1906 patent) said he found his own reading of the specification of 1906 not dislodged by the evidence, and he came regretfully to the conclusion that the specification of 1906 anticipated and invalidated the patent of 1909. He said regretfully, for he could not help feeling that in these proceedings a real inventor had lost the fruit of his invention. The fact stood that drawn tungsten wire, with its quality of ductility and strength was, prior to 1906 and the appearance of that patent, desired by all and attained by none. But by the year 1911, in the light of what had been disclosed by 1906—helped, it might be, by 1909—it was a reality on the market. Yet neither patent afforded protection to the inventor. Surrendering his own view in the Duram case as he was bound to do, he must say that the inventor foolishly opened his mouth too wide in the 1906 claim. His moral belief as to what happened was that working on the lines of 1906, he came to what he thought the most appropriate temperature and most appropriate steps, and then sought to make a new patent of what was only the picking out of a most excellent way. The fact remained that the claim of 1906 ruined the patent of 1906, and the result, he thought, followed in law that the disclosure of 1906 ruined the patent of 1909. He therefore agreed with the view expressed by Lord Haldane.

Lord SHAW (who also sat when the Duram case was heard) said he adhered in its entirety to the opinion he then delivered, and he further thought that the reasons arrived at by the majority of the House, if applied to the facts of the present case, would show that claims one and two in the 1909 patent failed. He thought both claims were bad. Claim one was for "a body of mechanically worked tungsten which is ductile at ordinary temperature"—that was for a thing, and fell under the opinion which he had already delivered. Claim two was for "The method which consists in the repeated working of a body of coherent tungsten while it is hot until it becomes ductile at ordinary temperature"—that was for a method which discovered (in the active sense) a property of the material worked upon. The method was the repeated working of coherent tungsten—a claim already held in the 1906 case to be too wide. This discovery that tungsten became ductile when cold when sufficiently worked was merely a discovery of something in nature, for which discovery no contribution of inventive ingenuity was made. He agreed with Lord Haldane, as did Lords Buckmaster and Blanesburgh, so the House unanimously dismissed the English appeal and allowed the Scottish one, the British Thomson-Houston Co. thereby losing.

Shiels v. Ellis.

IN the Bow County Court recently, before Deputy-Judge Higgins, Mr. R. J. Shiels, Forest Gate, an electrical contractor, sued Mr. L. Ellis, fancy goods trader, Forest Gate, to recover £35 for material supplied and work done.

The plaintiff stated that he was employed under defendant's instructions, to install electric lighting at the defendant's private address, and supplied about £120 worth of electrical fittings. He started the work in January, 1921. Mrs. Ellis, wife of the defendant, asked him to install electrical fittings at her private address and he did so. He had received the bulk of the money due.

Mrs. ANNIE ELLIS stated that after the work was done the plaintiff came round to her house, and said, "If you give me another £10 the account will be settled." She spoke to her husband with reference to this, and he gave her a cheque for the £10, which was sent to plaintiff.

Mr. ELLIS said that he was asked by his wife for a cheque for £10 in final settlement, which he gave. He had never had any invoices.

The JUDGE found in favour of the plaintiff for the amount claimed and costs.

Claim for Electricity Supplied.

AT the Scarborough County Court recently his Honour Judge Head heard a claim by the Scarborough Electric Supply Co. against Mr. J. Jackson for £3 1s., the balance of an account for electricity supplied by the company.

His Honour asked for the production of the contract under which the electricity was supplied. Mr. F. S. H. WARD, for the plaintiffs, said that there was no written contract as the price of electricity was fixed by the Government. As his Honour persisted, however, that there must be some sort of contract, a book was produced which, it was stated, contained an agreement between the company and the defendant. The Judge observed that there was nothing in it to protect Mr. Jackson from incorrect meter readings.

The defendant stated that although he had exercised the greatest economy his bill for the quarter in question was larger than that of the previous quarter.

A meter reader gave evidence to the effect that if the meter was registering incorrectly it was in favour of the defendant.

Judgment was given for the plaintiff company, with costs.

False Pretences Charge.

AT the Old Street Police Court, on February 5th, Albert Weale, a traveller, was charged, on remand, with endeavouring to obtain money by false pretences and having in his possession goods bearing a false trade description. The defendant's first appearance was reported in our last issue. It was stated that the defendant's brother, for whose attendance the case was adjourned, was not present, although every effort had been made to get him there. After the defendant had been cross-examined, the magistrate said that having regard to his previous good character and to the fact that the goods were not actually worthless, he would bind him over on the charges of false pretences in the sum of £50 for a period of 12 months and fine him £5 on the summons.

Climax Patents, Ltd., v. Wates Bros.

ON January 30th, in the Chancery Division, before Mr. Justice Tomlin, the plaintiffs applied for an injunction restraining the defendants from passing off copper earthing tubes for radio purposes as "Climax" tubes. For the plaintiffs it was stated that one of their directors asked at the defendants' shop for a "Climax" tube, and was sold a tube, at the same price, which was not of plaintiffs' manufacture. Mr. F. S. Wates, managing director of the defendant firm, said that he had no knowledge of the plaintiff company apart from the fact that he knew that it was advertising tubes. He certainly gave no instructions that the tubes which his firm had purchased should be sold as "Climax" tubes. Two assistants stated that the plaintiffs' director asked for a "Climax" tube. They did not know of such a tube, but producing one of the copper tubes which were in stock, they showed it to the director, who said that it would do. The bill was made out stating that the tube was a "Climax" tube. His Lordship dismissed the motion, with costs, saying that there was no ground for any suggestion of passing-off.

Brown v. Sperry Gyroscope Co., Ltd.

ON February 5th, Mr. Justice Tomlin delivered judgment in this case, in which the plaintiff asked for an order restraining defendants from infringing his patent for the elimination of the quadrantal error in the gyroscopic compass. The hearing lasted for about 20 days owing to the amount of technical evidence which was heard.

His LORDSHIP found that plaintiff's patent was valid, but that the compass made by the defendant company did not embody or infringe the patent. The action was accordingly dismissed.

Sterling Telephone and Electric Co., Ltd., v. Direct Wireless Co.

A MOTION by the plaintiffs for an injunction restraining the alleged infringement of a patent by the Direct Wireless Co., of Leeds, by selling headphones below the price fixed by the plaintiffs came before Mr. Justice Romer in the Chancery Division on February 4th.

Mr. MORITZ said he had received an affidavit on behalf of the defendants denying the allegation. A representative of the defendants was present, and supported the denial.

Mr. MORITZ said enormous damage had been done to the plaintiff company by the sale of these particular articles at less than the proper price.

The motion was adjourned for a week, the defendants giving an undertaking in the meantime.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

18,371. "Operation of semi-automatic electric sub-stations." B. Thomas. July 17th, 1923. (227,478.)

23,233. "Transmission of electromagnetic waves by means of thermionic tubes." Dr. E. F. Huth Ges. and Dr. L. Kuhn. September 16th, 1923. (204,064.)

23,370. "Electric arc devices." British Thomson-Houston Co., Ltd. (General Electric Co.). September 18th, 1923. (227,487.)

23,401. "Sound-reproducing apparatus." J. G. A. Kitchen. September 19th, 1923. (227,488.)

23,680. "Electric heating apparatus." R. Crust. June 18th, 1924. (227,492.)

24,857. "Telephone trunking schemes." Relay Automatic Telephone Co., Ltd., and E. J. C. Rousseau. October 5th, 1923. (227,497.)

25,173. "Mechanism for converting oscillating movement into a step-by-step rotational movement in electrically-driven indicators." C. E. Prince. October 9th, 1923. (227,499.)

25,392. "Mounting panels for wireless or other instruments." J. F. Jackson and C. R. Heron. October 12th, 1923. (Cognate application 9,674/24.) (227,503.)

25,571. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., R. Mercer, W. H. Paulett, and F. Tench. October 13th, 1923. (227,510.)

25,724. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. October 18th, 1922. (205,802.)

25,803. "Crystal rectifiers for wireless receivers." M. M. Melinsky. October 16th, 1923. (227,520.)

25,859. "Balanced electric protective arrangements for alternating-current systems, and relays therefor." A. Reyrolle & Co., Ltd., and B. H. Leeson. October 16th, 1923. (227,523.)

25,921. "Balancing signalling conductors with artificial lines." Western Electric Co., Ltd. December 16th, 1922. (208,515.)

26,243. "Auxiliary lights for motor vehicles." J. H. Runbaken and W. Torrance. October 20th, 1923. (227,537.)

26,368. "Electric welding machines." N. P. Sjobring and M. Swanson. October 22nd, 1923. (227,543.)

26,625. "Trumpets or horns for wireless apparatus, gramophones, and other sound-amplifying, recording, and reproducing instruments." C. S. Forbes. October 24th, 1923. (227,545.)

27,068. "Bonding devices for use in electric wiring systems." Johnson and Phillips, Ltd., and H. J. Groves-Webb. October 29th, 1923. (227,547.)

27,787. "Electric condenser." Lissen, Ltd., and R. P. Richardson. November 5th 1923. (Cognate application 329/25, a divided application on 27,787/23.) (227,556.)

27,799. "Cooling of dynamo-electric machines of the commutator type by fans." British Thomson-Houston Co., Ltd., and A. A. Pollock. November 5th, 1923. (227,557.)

28,001. "Telephone receivers and the like." L. G. Toplis. August 1st, 1924. (227,560.)

28,013. "Telephone receivers." G. Green and A. J. Younger. July 25th, 1924. (227,561.)

28,394. "Tuning devices for use in wireless transmission or reception apparatus." R. W. Tarrant. November 10th, 1923. (227,567.)

28,466. "Carrier-wave transmission systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). November 12th, 1923. (227,568.)

28,854. "Electric switch-operating mechanism." Igranic Electric Co., Ltd., and F. Bergmann. November 15th, 1923. (227,573.)

29,592. "Electromagnetic wave-receiving apparatus." E. E. Rocke. November 23rd, 1923. (227,577.)

30,738. "Mountings for thermionic valves." Sterling Ttelephone and Electric Co., Ltd., T. D. Ward-Miller, and W. M. Holbeach. December 6th, 1923. (Cognate application 4,820/24.) (227,590.)

31,849. "Aerials for antennæ for radio-apparatus." J. W. Tierney. December 19th, 1923. (227,604.)

31,952. "Electrolytic methods of refining or reduction." Aluminium Co. of America. November 5th, 1923. (224,488.)

32,121. "Head-lights for motor vehicles." E. P. Bone. December 21st. 1923. (227,607.)

32,305. "Remote control system." Coventry Automatic Telephones, Ltd., and C. C. Puckette. December 27th, 1923. (227,610.)

32,406. "Earthing clips for wireless and electric conductors." L. H. Reid. December 28th, 1923. (227,613.)

1924.

44. "Junction boxes for electrical wiring systems." E. L. Mann and J. P. Castle. January 1st, 1924. (227,618.)

426. "Device for floor-levelling of electric lifts." W. C. Karasek. January 7th. 1924. (227,619.)

864. "Coil holders for wireless apparatus." A. P. Portway. January 11th, 1924. (227,624.)

2,178. "Trolley poles of electric tramway vehicles." C. Broderick. January 28th, 1924. (227,634.)

3,964. "Electric clocks." C. Appelmans. February 15th, 1924. (227,651.)

4,415. "Apparatus for carrying out radiotherapeutic treatment of diseases." Dr. L. Cappelli. February 20th, 1924. (227,654.)

5,653. "Electropneumatic valves for compressed-air brakes." Compagnie Générale d'Electricité. March 16th, 1923. (212,898.)

6,648. "Manufacture of vessels adapted to be electrically heated." J. Wangler Ges. April 4th, 1923. (213,897.)

6,766. "Electric heaters for melting bitumen or the like for use in coal mines and similar places." H. Green. March 17th, 1924. (227,670.)

7,475. "Tensioning ring for sound-reproducing diaphragms." F. A. E. Jenkins. March 24th, 1924. (227,672.)

8,330. "Spring terminal for electrical connections." E. J. Furlong. April 2nd, 1924. (227,675.)

8,976. "Crystal detectors." A. W. Harris and G. Newson. April 9th, 1924. (227,680.)

9,164. "Method of reducing cross-talking in telephone cables." Felten and Guilleaume Carlswerk Akt. Ges. September 26th, 1923. (222,436.)

9,341. "Electric gear for power transmission, more particularly for ships' propulsion." F. Bruggemann. April 12th, 1924. (227,683.)

10,296. "Electric lamp holders." J. Piechocinski. April 25th, 1924. (227,691.)

10,933. "Means for protecting electrical apparatus from excess of tension or voltage." Soc. Générale d'Entreprises. May 5th, 1923. (215,381.)

10,957. "Electric control apparatus." British Thomson-Houston Co., Ltd. May 3rd, 1923. (215,384.)

11,939. "Combined electric temperature-regulating and time-switch apparatus." E. Matter. May 7th, 1924. (227,695.)

11,633. "Winding multi-layer electrical coils for use as inductances and resistances and the like for wireless radio-telegraphy, radio-telephony, and the like." S. J. Williams. May 10th, 1924. (227,697.)

11,833. "Electrothermic fire-alarm." P. Ameglio. May 13th, 1924. (227,700.)

12,282. "Means for controlling the head-lamps of road vehicles to obviate glare." C. F. Browne, T. W. Cotton, and E. F. Farrow. May 19th, 1924. (227,702.)

12,481. "Transformers for electrical resistance welding and heating machines." E. Schröder. May 21st, 1924. (227,706.)

14,531. "Tungsten arc lamps." General Electric Co., Ltd. December 21st, 1923. (226,481.)

14,552. "Electric transformers." British Thomson-Houston Co., Ltd. June 16th, 1923. (217,607.)

14,571. "Electrodes for jet-wave commutators and interruptors." J. F. G. P. Hartmann. June 16th, 1924. (227,720.)

14,572. "Electrodes for jet-wave commutators and interruptors." J. F. G. P. Hartmann. June 16th, 1924. (227,721.)

14,726. "Sparking plugs for internal-combustion engines." Soc. J. De Saint-Martin & Chabrolle. June 23rd. 1923. (217,908.)

15,960. "Apparatus for rectifying alternating currents." P. Kammerer. July 4th, 1923. (218,663.)

16,975. "Lead-in for anodes of mercury-vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. August 3rd, 1923. (219,967.)

17,171. "Electric ignition timers or distributors for internal-combustion engines." V. Shearer. July 17th, 1924. (227,735.)

18,324. "Insulators." British Thomson-Houston Co., Ltd. (General Electric Co.). July 31st, 1924. (227,743.)

21,480. "Electric switches." E. Pasquet. September 12th, 1923. (221,818.)

23,084. "Insulators." British Thomson-Houston Co., Ltd. (General Electric Co.). September 30th, 1924. (227,767.)

23,708. "Ignition plugs for starting heavy-oil engines." R. Bosch Akt. Ges. November 23rd, 1923. (225,186.)

Explosives for Use in Coal Mines.—Colonel G. R. Lane-Fox, M.P., Secretary for Mines, announces that as part of its inquiry into the possibility of improving the present official tests to which explosives are submitted before they are "permitted" for use in gassy or dusty coal mines in Great Britain, the Safety in Mines Research Board arranged for seven typical British "permitted" explosives to be put to the official tests applicable to American "permissible" mining explosives. The Board has been officially informed that all the British explosives passed the American tests.